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OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND

INCLUDING

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Binding of Back Volumes of the Journal.

THE Journal is issued this year to Governors and Members, bound in paper covers, and MESSRS. JAS. TRUSCOTT & SON, LTD., have contracted to bind this and back Volumes to match the Bound Volumes issued by the Society from 1901–4, and 1912–14, at the following rates :—

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To avoid confusion, the Volumes of the Journal have been renumbered from the beginning, and the following Table shows both the Old and the New Numbers of each of the Volumes which have been issued since the first appearance of the Journal in 1839 :—

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„ 61. 1900..	„ XI. „ I. (41), II. (42), III. (43), & IV.
„ 62. 1901..	Issued as an Annual Bound Volume.
„ 63. 1902..	Issued as an Annual Bound Volume.
„ 64. 1903..	Issued as an Annual Bound Volume.
„ 65. 1904..	Issued as an Annual Bound Volume.
„ 66. 1905..	Issued as an Annual Volume in paper covers.
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„ 69. 1908..	Issued as an Annual Volume in paper covers.
„ 70. 1909..	Issued as an Annual Volume in paper covers.
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„ 96. 1935..	Issued as an Annual Volume in paper covers.

(The numerals within brackets indicate the numbers as printed on the several Parts of each Series.)

KING GEORGE V.

The Members of the Royal Agricultural Society of England have joined with their fellow citizens throughout the Country and the Empire in sorrow and in mourning for the death of King George V.

The Society has to mourn the loss of a Royal Patron who, in the midst of the manifold cares and duties of State, ever took a friendly and personal interest in its work and well being.

At the first meeting of Council after the death of His Late Majesty, the President, Sir Merrik Burrell, moved the Addresses which are printed below, and spoke as follows :—

My Lord Duke, my Lords and Gentlemen, I regret most deeply that it is my first duty in our new year to have to ask you to consider and approve Addresses of Condolence to Their Majesties on the death of our Patron, King George V. It would be impossible for us to have a more distressing duty to perform. All through King George's connection with this Society he never failed to give us his help and his encouragement on any and every opportunity possible. As an agriculturist he was in the first rank; no man ever surpassed King George's successes in breeding so many high class pedigree stock of so many sorts. He was a kindly squire, a model landlord and a real sportsman, and in his love of the things of the country he was truly one of us. The loss of such a Patron is indeed severe.

But, great as is the loss to us of our Patron, it is as nothing compared with the loss to the whole country of our King, a King eloquent, wise, firm, tactful, and with an unsurpassed devotion to duty which never failed him in a long reign more full of difficulties, dangers and stress of mind than any since that of Charles II, that sagacious man who, while saving the Crown from bankruptcy, yet was able to find means to found our great Navy, in which King George was so proud to serve.

The loss even of our King is yet less than the loss to the British Empire of its Emperor. The obvious sincerity of his devotion to the welfare of all within the Empire made him beloved by the peoples of hundreds of different races and creeds, and their love for him was the cement between the stones of our imperial edifice, a cement so strong that the tears of the thousand million eyes of his sorrowing subjects will not melt it, but will tend rather to make it set the harder.

Besides being a wise King and a great and beloved Emperor, he was something which perhaps earned him even more the universal respect that he had, and endeared him to the humblest of his subjects; he was a sincerely good man, a devoted husband, an affectionate father, and a grandfather proud in the love of his grandchildren.

I ask you, therefore, to forget for a moment your personal regrets, some of you in the loss of a friend and all of us in the loss of our King and our Patron, in the realization of the bitter grief of Queen Mary, the best helpmate that any man has ever had, be he king, peer or commoner, in the loss of her husband, and of King Edward and his sister and brothers in the loss of their father. Their loss can never be made good, whereas our loss has already been filled, for we have the great consolation in the feeling of certainty, born from our experience of King Edward VIII, that he will follow, and will follow successfully, in the footsteps of King George and will continue to prove himself an understanding friend to agriculture. He has already shown himself to be a wise and sympathetic landlord in the Duchy of Cornwall.

Therefore, my Lord Duke, my Lords and Gentlemen, I feel that I am voicing not only the thoughts of all of you in this Council room this morning, and not only the thoughts of every member of the Royal Agricultural Society of England, but the thoughts of every subject of His Majesty when I say that we wish him well in the years to come. We wish him good health, good fortune and true friends to help him through his heavy task, and also—I say it not as a mere phrase but as a heartfelt prayer—"God save King Edward."

I will ask the Secretary to read the Addresses of Condolence which it is proposed should be sent to His Majesty the King and Her Majesty Queen Mary.

I propose that the Addresses be engrossed on vellum, sealed with the Society's seal and forwarded to Their Majesties through the Secretary of State for Home Affairs.

The members of the Council signified their approval by standing in silence.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

To The King's Most Excellent Majesty.

May it please Your Majesty:

We, the President and Council representing the general body of Governors and Members of the Royal Agricultural

Society of England, desire humbly to approach Your Majesty with the assurance of our loyal and devoted attachment to Your Majesty's Throne and Person, and of our sincere and respectful sympathy with Your Majesty on the occasion of the grievous loss which the Royal Family have sustained by the death of our beloved Sovereign, His late Majesty King George, and of our profound sorrow at the sad event which has plunged the whole of the British Empire into mourning.

We desire to pay a humble tribute of loyalty and respect to the memory of a Sovereign who, throughout his life and reign, devoted himself unremittingly to the calls of duty in his exalted station, and who endeared himself to all his subjects by his constant sympathy with both their joys and sorrows.

The Royal Agricultural Society recalls with feelings of pride and satisfaction that His late Majesty had been Patron of the Society during the whole of his reign. As Duke of York in 1897, as Prince of Wales in 1903 he filled the office of President, and in 1911, on the occasion of the Society's Show at Norwich, the capital of the County in which His Majesty had for so many years made his country home, His late Majesty again graciously consented to become President of the Society.

We beg to assure Your Majesty that the agriculturists of England are devotedly attached to your Throne and Person, and on their behalf we desire respectfully to express our grateful thanks for the gracious interest ever taken by His late Majesty in the welfare of the agriculture of the country.

The Royal Agricultural Society has received so many marks of Royal favour that we venture to express the hope that it may still continue to merit Your Majesty's gracious patronage.

We earnestly pray that the Almighty may vouchsafe to Your Majesty health and strength for many years to come to guide the destinies of the Empire over which Your Majesty has been called to reign.

Given under the Common Seal of the Royal Agricultural Society of England this fifth day of February, 1936.

Seal.

MERRIK R. BURRELL, President.
C. ADEANE, Trustee.
T. B. TURNER, Secretary.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

To Her Most Gracious Majesty Queen Mary.

May it please Your Majesty:

We, the President and Council representing the general body of Governors and Members of the Royal Agricultural Society of England, beg leave humbly to approach Your Majesty with the assurance of our loyal and devoted attachment to Your Majesty's person and of our sincere and respectful sympathy on the occasion of the death of His Majesty King George, Patron of this Society.

We, in common with all classes of the community, deplore the death of His late Majesty, whose loss will more especially be felt by this Society in which His Majesty had for so many years taken the warmest personal interest.

We recall with feelings of gratitude the many occasions on which Your Majesty accompanied King George on his visits to the annual shows of this Society, and the deep interest shown by Your Majesty in the Society's operations for the advancement of agriculture.

In the name and on behalf of the agriculturists of England, we humbly pray that the Almighty may send His Blessing to comfort you in the irreparable bereavement sustained by Your Majesty.

Given under the Common Seal of the Royal Agricultural Society of England this fifth day of February, 1936.

Seal.

Merrik R. Burrell, President.
C. Adeane, Trustee.
T. B. Turner, Secretary.

LORD CORNWALLIS.

THE JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND

LORD CORNWALLIS.

FIENNES STANLEY WYKEHAM CORNWALLIS, C.B.E., first Baron Cornwallis, died on Friday, September 27th, 1935, at the age of seventy-one years.

It would be difficult to exaggerate the loss which the Royal Agricultural Society has suffered by his death, for he had been a very active member of the Council for the long period of forty-two years, and had maintained the keenest interest in the Society's affairs until he was laid aside by his last illness. He was President of the Society in 1906, and was Chairman of the Journal and Education Committee up till the time of his death.

Lord Cornwallis was educated at Eton and thence went to Sandhurst with the intention of taking a commission in the regular army. During the course of his military training, however, he succeeded to the Linton estate, near Maidstone, in Kent, and thereafter decided to abandon the idea of an army career. He devoted the rest of his life to the management of his estates and to public work.

As time went on, his great capacity for affairs and his devotion to the public service became widely recognized, while his personal popularity increased until it reached a level that is rarely equalled. The result was that he was called upon to fill, one after another, a very large number of important and responsible positions in public life.

In his own county he was familiarly and affectionately known as "The Squire of Kent," a title that happily conveys a great many of the qualities that were combined in his personality—his intense love of his county, his deep interest in country affairs and country folk, the keen pleasure which he took in all the traditional English rural sports, and his simple ways of life.

Lord Cornwallis gave to county affairs a very generous share of his time and energy. He was Vice-Chairman of the County Council from 1900 till 1910 and thereafter Chairman until 1930. In the latter capacity his wide knowledge of administration, his shrewd judgment, his tact, and above all his conspicuous fairness, won him the warm regard of all parties.

In 1888, and again in 1892, Lord Cornwallis (Mr. Cornwallis as he was then) stood as Parliamentary Candidate for Maidstone, and was elected on both occasions. It would seem, however, that party politics and the life of the House of Commons were not very much to his liking, and although he was persuaded to stand again in 1898, and was again elected, he never became a whole-hearted parliamentary man. The reason was, in part at least, that he had too little ambition for personal success. Indeed, anything savouring of self-advertisement was quite foreign to his nature.

Lord Cornwallis was a leading figure in Freemasonry and was especially interested in the

Masonic Charities. He became Worshipful Master of his Lodge in 1894, Provincial Grand Master of Kent in 1906, and in 1926 was elected Deputy Grand Master of England. In the latter capacity he went on important missions to India (in 1928) and to Canada and the United States (in 1931). On the latter occasion it happened that the Americans were celebrating the anniversary of the Surrender of Yorktown, where General Cornwallis had been obliged to capitulate to the Colonists. Characteristically, Lord Cornwallis accepted the invitation of the United States authorities to attend the celebration of the defeat of his own ancestor and, seeing both the humorous side of the situation and the opportunity for creating international good feeling, he went through with the affair in a manner that quite won the hearts of the American people.

It has already been said that Lord Cornwallis derived keen enjoyment from country sports and games. He hunted the Linton Pack of Beagles from 1888 till 1932 and provided many enjoyable days' sport for his neighbours, all of whom, of whatever class, were his personal friends. He was a fine cricketer, and maintained the keenest interest in the game for the whole of his life.

Lord Cornwallis held a commission in the West Kent Yeomanry and, before the Great War, had risen to the command of the Regiment. It was one of the regrets of his life that he could not obtain permission to lead the regiment overseas, but as soon as that decision had been reached he threw himself wholeheartedly into war work at home, and played an important part in the food production campaign.

Lord Cornwallis took a keen personal interest in agriculture and in his own farm. Whatever leisure he had from his public work he spent largely in his fields and among his stock, and it was no uncommon

thing, when hay or harvest was pressing, to see him hard at work alongside his labourers.

Among the offices which he held in the agricultural world may be mentioned (apart from the Presidency of this Society) those of President of the Bath and West Society in 1925, and President of the Kent or Romney Marsh Sheep Breeders' Association for the year 1931.

His last important appointment was to the Chairmanship of the Royal Commission on Tithe, and up till the time of his last illness he was working, with all his characteristic sincerity of purpose, to find a just and final solution to the difficult and centuries-old problems connected with tithe rent-charges.

Lord Cornwallis's public services were recognized by His Majesty in 1907, when he was raised to the Peerage.

Enough has perhaps been said of Lord Cornwallis's achievements, which were notable enough; yet it must be added that his achievements were no real measure of the man. He might, had he so willed, have risen to a position of much greater eminence, but he had no thought of self-aggrandisement. The strongest memories of him that will remain are those of his geniality, his quiet and modest efficiency and his unfailing desire to help forward any cause or movement that he believed to be in the public good. He was a very perfect English gentleman.

IN DEFENCE OF MIXED HUSBANDRY.

The title chosen for this article is one which has formed the basis for a certain amount of debate in recent years, although differences of opinion can frequently be attributed merely to misunderstanding of the meaning in which the term "mixed husbandry" is employed. The subject is really more suited to academic discussion than to scientific investigation, for while the arguments for and against the opposing view-points can be easily illustrated in theory, it is extraordinarily difficult to obtain in practice any satisfactory quantitative measurement of the different factors concerned. The purpose of this article is not to review *seriatim* the pros and cons of mixed and specialized farming, for these will be found in any text book on Farm Management. Our object is rather to examine the extent to which diversified methods of organization are practised in the eastern arable counties of England, and to attempt to assess some of the economic advantages which accrue.

But before going further let us try to define more clearly what we mean by mixed husbandry. This is no easy task, for although the terms "specialized" and "mixed" farming are in common circulation they are open to diverse interpretations. The term "specialization" for example, has been used at one time or another to describe farms on which (1) only one commodity is produced, (2) a number of commodities are produced but only one is sold, (3) one commodity occupies a more conspicuous position than others, or (4) one or more commodities are produced on a scale large enough to justify the employment of special equipment or methods. For the purpose of this particular study, however, specialization is taken to mean the *production* of only one *type* of commodity, together with any unavoidable joint product (*e.g.* grain *and* straw), and the term mixed farming will, therefore, cover systems ranging through many degrees of variation from semi-specialized to semi-diversified. It is true that this definition is too loose to have any real practical significance, but it will be readily agreed that, even on much more precise and exclusive terms, mixed farming would be found to preponderate in overwhelming proportions in Great Britain.

Historically agriculture in Britain may be said to have developed from systems of extensive monoculture to relatively intensive methods of mixed husbandry. Virgin land, first used for pastoral purposes by nomadic tribes, was gradually brought into some simple form of cropping for human food as fixed settlements were established, and then with the increasing pressure of population, and as natural fertility became exhausted, systems combining both livestock and crops became important.

The introduction of turnips and clovers in the 18th century marked an immense advance in production technique, for whereas previously livestock numbers could be increased only by breaking in fresh land or by reducing the area of crops for human food, thereafter livestock and crops became complementary instead of competitive.

It is significant that this tendency for farming methods to develop eventually along the lines of mixed husbandry has been accompanied by a relative fall in the price of food. While the reasons for this price fall are undoubtedly complex, it may be assumed that producers have found that, for one reason or another, diversified methods have enabled them to reduce costs more satisfactorily than monoculture. Perhaps the most obvious advantage offered by diversification is the opportunity to increase income through the utilization of unsaleable by-products generated with the primary products. For example, straw, poor-quality grain, or sugar-beet tops may be made to add to the farm income through the medium of livestock; skim milk may be cashed as pig meat; dung can contribute to the farm income by increasing the productivity of the land. If these by-products are not utilized, the gross income of the farm could be maintained only by purchasing equivalent feeding and manurial values. In addition to these measurable by-products, there are others of a less apparent nature such as the fertility generated by long leys and leguminous crops, the manurial effect of folding, and the cleaning value of inter-cultivated or smother crops.

A second obvious advantage offered by diversification is the possibility it provides of reducing costs per unit of produce by spreading fixed charges. This advantage is of particular importance in crop production, in which the demands for labour, capital and management are very variable throughout the year. For example, nine-tenths of the total direct labour requirements of the wheat crop occur in the four months August to November, while a similar proportion of the demands made by the hay crop fall into the two months June and July. Diversified cropping spreads the demand for, and therefore the effective working period of, the agents in production, and so tends to increase their productivity, or to reduce their cost per unit of produce.

But in addition to distributing the demands for labour and capital, mixed husbandry must also be given the credit of spreading the farmer's income throughout the months of the year. This advantage is perhaps more real than apparent, but it will probably be agreed that it takes an exceptionally prudent man to make a lump sum down a satisfactory substitute for regular instalments of income. In crop production, at least, income is not distributed evenly throughout the year. For example,

receipts from sugar beet are mainly confined to the three months October, November, and December, while cereal sales are largely effected during the six months October to March. Some vegetable and fruit crops have a sale period of only a few weeks. But livestock, particularly dairy cows, poultry and pigs, can be made to provide a fairly constant income throughout the year, and thus to compensate to a certain extent for the seasonal nature of receipts from crops.

Mention must also be made of the advantages which mixed husbandry offers of spreading the risks of price fluctuations, of weather vagaries, and of diseases and pests. Nor is it irrelevant to refer in this connection to the biological nature of the soil, and the fact that its productivity is dependent both on its chemical and physical properties. Again, the comparative flexibility of mixed husbandry facilitates expansion or contraction in directions dictated by changes in price and cost levels. Further, a reasonable amount of diversification renders the farmer less dependent on external purchases for his private material requirements, which must be an important consideration to those who are compelled to sell wholesale and buy retail. But these advantages, important as they undoubtedly are, are perhaps even less amenable to quantitative measurement than the three already enumerated above.

It is not the intention of the foregoing to imply that mixed husbandry is incompatible with *departmental* specialization. It is clear that large-scale production of individual commodities may lead to certain economies through capital outlay on the most efficient machinery and appliances, and through the application of highly trained labour and management. Where a farm is large enough, its organization may be diversified, and yet it may reap the advantages of specialization for each, or at least some, of its departments. If it carries sufficient cows, pigs, and poultry, a specialist, making use of the most modern equipment and methods, may be in charge of each department; if, in addition, it has more than a certain acreage of cereals, the purchase of a " combine " may be justifiable. In such a case the economic advantages both of specialization and diversification are obtained. But modern developments in machinery and equipment have greatly increased the minimum size of the economic unit for specialized production, and few farms are large enough, and still fewer managers have the ability, to secure this dual advantage. Only about 3 per cent. of the holdings in England and Wales are over 300 acres in size, while 45 per cent. are less than 20 acres. Even omitting holdings of less than 20 acres, the " average " size of farms in England is some 100-150 acres, with a total capital investment in live and deadstock of about £10 per acre, and a gross income of about £7 an acre. Perhaps

larger business units are desirable (although clearly there is an upper as well as a lower limit to the economic size), but we cannot expect holdings to be engrossed and re-equipped overnight, and must make the best of conditions as we find them.

Let us turn now from these preliminary generalizations to investigate the extent to which mixed husbandry is practised in the Eastern Counties of England. It is true that it is very difficult to obtain a satisfactory measure of diversification, but simple frequency distribution tables may give some idea of the position. First of all it should perhaps be explained that even within the comparatively narrow confines of this predominantly arable district, systems of farm organization are by no means uniform. Certain major " type areas " can be clearly distinguished, and the differences in farm organization which characterise these areas are due largely to variations in soil types and marketing facilities. But in all these areas mixed husbandry is predominant, and the differences observed concern the proportions in which the different products are combined rather than the type and number of the products.

TABLE I.

PERCENTAGE COMPOSITION OF GROSS FARM INCOMES IN CERTAIN " TYPE AREAS."

	Percentage composition of Gross Incomes :—			
	Central Norfolk	Hunts. and West Cambs.	South Herts.	South Essex
Source of Income—	%	%	%	%
Dairy produce	19	16	42	50
Horned stock	15	13	13	13
Pigs	12	16	10	4
Poultry and eggs	9	9	10	11
Sheep and wool	5	5	6	4
Cereals*	21	23	8	5
Roots	17	6	5	5
Other crops	—	8	2	5
Miscellaneous	2	4	4	3
Total Incomes*	100	100	100	100

* Excluding wheat deficiency payments.

Four " type areas," selected because of their dissimilarity in soil and marketing conditions, will be used to illustrate the extent of diversification. These four areas are respectively (1) central Norfolk, in which the soil is predominantly a medium loam, and where population is relatively sparse ; (2) the heavy clay district of west Cambridge and Huntingdonshire, which is also a rural area ; (3) the relatively densely populated suburban area of south Hertfordshire, which comprises diverse soil types ;

(4) the heavy London Clay district in south Essex, adjacent to the Metropolis and the manufacturing towns which fringe the north bank of the Thames estuary. The average percentage composition of gross incomes in these four areas in 1933 is shown in Table I. [1]

On 100 farms over 20 acres in size chosen at random in each of these districts it was found that the great majority *produced* more than 10 commodities. In central Norfolk the proportion was as high as 92 per cent., and at the other end of the scale was the predominantly grassland dairying district of south Essex with 54 per cent. of farms producing more than 10 commodities. Table II. shows the frequency distribution, and demonstrates that an appreciable proportion of farms produced more than 15, and a small number more than 20 commodities.

TABLE II.

FREQUENCY DISTRIBUTION OF THE NUMBER OF COMMODITIES PRODUCED ON INDIVIDUAL FARMS IN CERTAIN "TYPE AREAS."

	Percentage of farms producing more than :—		
	Ten Commodities	Fifteen Commodities	Twenty Commodities
Type Area—	%	%	%
Central Norfolk . .	92	40	4
Hunts. and West Cambs. .	84	31	2
South Hertford. . .	63	16	1
South Essex . . .	54	11	—

It is important to appreciate that no very fine distinctions were made in classifying the various commodities. By-products such as straw, sugar beet tops, dung, skim milk, etc., were not enumerated separately, nor was distinction made between such commodities as malting and feeding barley, early and main crop potatoes, meadow and seeds hay, mutton and lamb, pork and bacon, mature beef, baby beef, and veal, breeding livestock and butcher livestock, butter, cream and cheese. Had a more detailed classification been adopted the number of commodities might quite well have been increased to half as many again.

A further illustration of the extent of diversification in these areas is provided by Table III. which shows, for the same sample, the percentage of farms on which certain categories of commodities are found. Cereals, fodder roots, hay, cattle and fowls are found on over 70 per cent. of farms in all four areas, and on over 90 per cent. in some. Cash roots, milk,

[1] See Cambridge University Farm Economics Branch *Report* 22.

TABLE III.

PERCENTAGE OF FARMS PRODUCING VARIOUS CATEGORIES OF COMMODITIES IN CERTAIN "TYPE AREAS."

	Percentage of farms producing certain commodities			
	Central Norfolk	Hunts. and W. Cambs.	South Herts.	South Essex
Category of Commodity.	%	%	%	%
Cereals	97	93	73	72
Pulse	33	70	2	32
Fodder roots	97	76	77	72
Cash roots	74	57	51	57
Hay	93	95	96	98
Small seeds	11	31	3	8
Fruit and market garden crops	13	33	34	24
Grass	100	100	100	100
Horses	17	19	4	13
Cattle	98	95	100	98
Whole milk	71	58	79	76
Butter, cream and cheese	58	46	23	9
Sheep and wool	25	43	39	34
Pigs	89	94	64	55
Fowls and eggs	91	95	86	94
Turkeys, geese, ducks	68	33	32	20

and pigs are all produced on over half the farms in each area. More will be said later in regard to the "representative" organization, but here it may be mentioned that without making any very fine distinctions in classification of products, few farms in these areas produce less than 8 or more than 18 commodities annually, the most common number being 12 or 13.

Of course many of the commodities produced are processed on the farm of origin, and do not appear directly in the Bank pass-book. Of these grass, hay, fodder roots, oats and beans are the most obvious, but varying proportions of the more pre-eminently "cash" crops are also marketed through the medium of livestock. Thus although the number of commodities sold can clearly not exceed the number produced, it is generally considerably less. Omitting sources of cash receipts which individually contribute less than 1 per cent. of the gross farm income, the number of different commodities sold off farms in these four "type areas" of the eastern counties seldom exceeds 9, although it is generally more than 5. Table IV. gives the frequency distribution of the number of commodities sold grouped by areas.

If Table IV. is compared with Table II., it will be seen that, roughly speaking, the number of commodities sold is about half the number produced. In central Norfolk, for example, 92 per cent. of farms produce more than 10 commodities, and

TABLE IV.

FREQUENCY DISTRIBUTION OF THE NUMBER OF COMMODITIES* SOLD OFF FARMS IN CERTAIN "TYPE AREAS."

	Percentage of Farms selling more than :—		
	Five Commodities	Seven Commodities	Nine Commodities
Type Area.	%	%	%
Central Norfolk . .	92	45	20
Hunts. and West Cambs. .	87	54	23
South Hertford . .	49	20	4
South Essex . . .	55	22	3

* Excluding sources which contribute less than 1 per cent. of the gross income.

the same proportion sell more than 5; 40 per cent. produce more than 15, and 45 per cent. sell more than 7; while 4 per cent. produce more than 20 commodities and 20 per cent. sell more than 9. It would appear that the "representative" farm sells about 6 different commodities.

But the gross income of the farm is not, of course, necessarily obtained in equal proportions from the various commodities sold. The majority of farmers in each of the type areas derive at least half their gross income from not more than two commodities, while in two of the four areas about half the farmers obtain more than three-quarters of their gross income from only two commodities. Table V. gives the data relating to the sample under discussion.

TABLE V.

PERCENTAGE OF FARMERS IN CERTAIN TYPE AREAS DERIVING ONE-HALF AND THREE-QUARTERS OF THEIR GROSS INCOME FROM ONE, TWO, OR THREE COMMODITIES.

	Per cent. of farms deriving more than half their gross income from			Per cent. of farms deriving more than three-quarters of their gross income from		
	One commodity	Two commodities	Three commodities	One commodity	Two commodities	Three commodities
Type Area.	%	%	%	%	%	%
Central Norfolk .	7	56	98	1	2	20
Hunts. and West Cambs. . .	13	60	92	2	13	32
South Herts. .	54	84	99	18	49	68
South Essex .	64	90	98	18	60	78

South Hertford and south Essex are both areas with a relatively large proportion of permanent grass, and are both highly dependent on whole milk as a source of income. On the other hand central Norfolk and the Huntingdon and west

Cambridge area have larger proportions of arable land and are comparatively remote from consuming centres.

Perhaps enough has now been said to illustrate the very considerable degree of diversity which characterizes farm organizations even in dissimilar type areas of the Eastern Counties. No doubt an unreasonable number of side lines may dissipate energies and resources on certain farms, and production efficiency and profits might here and there be increased by concentrating labour and capital on fewer enterprizes. But one cannot condemn as irrational the idea that a small flock of poultry may be kept *because* the farmer has tail corn or stubble pickings to dispose of, that room may be found for a few pigs *because* tail barley or surplus milk is available, that a flying flock of sheep may be introduced *because* sugar beet tops will otherwise have to be ploughed in.

This aspect may be considered in more detail by enumerating the by-products likely to arise in a farm organization typical of these arable districts. This "representative" farm may be assumed to be situated on a medium-strong loam soil, and to extend to about 140 acres. The organization will comprise cropping and livestock as detailed in Table VI.

TABLE VI.

CROPS AND LIVESTOCK ON A "REPRESENTATIVE" FARM OF 140 ACRES.

Crops.	Acres	*Livestock.*	Nos.
Permanent grass not for hay	33	Work horses	4
" " for hay	11	Other horses	1
Temporary grass and clovers	16		
Wheat	20	Dairy cattle	10
Barley	15	Other cattle	10
Oats	10		
Beans or peas	5	Breeding pigs	3
Sugar beet	8	Other pigs	15
Potatoes, sprouts or cabbage	2		
Mangolds, turnips or swedes	6	Poultry	250
Fallow	8		
Roads, buildings and waste	6		
Total acreage	140	Total "animal units"*	24

* One "animal unit" is equivalent to one cow, the different types and ages of livestock being converted to this common basis.

The principal by-products arising out of such an organization, and which can generally have only an internal use value, are

Livestock : Dung, skim milk.
Cereals : Straw, tail corn, stubble pickings.
Roots : Sugar-beet tops, chat potatoes, brussel-sprout stems, second-quality cabbages.
Hay : Aftermath.

These items may be regarded either as potential substitutes for or as potential additions to the raw material customarily purchased. But their utilization in either capacity will depend on the *relative* cost of processing, for clearly the farmer has no incentive either to reduce his gross costs or to increase his gross income unless his net income will thereby be raised.

The cost of processing such by-products is itself dependent on a number of variable factors, the nature of which may perhaps be illustrated from an individual example, say, the processing of whey, skim or surplus milk through the medium of pigs. If the price of pigs falls relative to that of pig meal, the cost of processing the dairy by-products will increase. On any particular farm there will eventually come a time, if this movement continues, when the cost of processing will exceed the value of the final product, and when it would be more economical to do away with the pig department and, unless some more suitable alternative outlet is available, pour the whey, skim or surplus milk down a drain. But this point will be reached sooner on a farm on which there are relatively small quantities of dairy by-products, than on one on which there are relatively large quantities, because purchased meals represent a larger proportion of total food requirements on the former than on the latter. Hence pig production as an adjunct to dairying can be maintained at a lower price level than will be the case where such by-products are not available. It must be appreciated that this example is merely an isolated illustration, shorn of the complexities with which, in practice, it would be festooned. It might equally well arise that, under certain conditions of price and cost, pigs would actually carry the dairy herd.

It may be of interest to assess the amounts of these different by-products which are likely to become available on our "representative" farm. From the livestock carried approximately 240 loads of dung will be produced annually. This amount is equivalent to about 2½ loads per arable acre, or 10 loads per acre every four years. Assuming that one load of dung weighs two-thirds of a ton, the plant food in this way made available annually will be roughly :—

2,000 lb. Nitrogen,	equivalent to	4½ tons of sulphate of ammonia.
800 lb. Phosphate,	,, ,,	2⅓ tons of superphosphate.
2,000 lb. Potash,	,, ,,	2 tons of sulphate of potash.

There is no means of measuring the mechanical effect of the dung, but this must be considerable as it will contain some 40 tons of straw. The other livestock by-product mentioned above is skim milk. In these areas about 15 per cent. of the milk produced is made into farm cream and butter, so that our "representative" unit will have about 700 gallons of skim to

dispose of during the year. This protein-rich food has also got a biological value which, although not amenable to measurement, must be of some importance.

Of the cereal and pulse by-products straw is the most important, and with normal yields the crop organization of the 140 acres farm should produce about 65 tons. Of this total nearly 30 tons will be wheat straw, an equal amount will be barley and oat straw, and the small balance remaining will be bean or pea haulms. The greater part of this will be required as litter, and the quantity thus used has already been referred to under the heading of dung. But even allowing for loss due to winds and storms about 20 tons should remain for coarse fodder, and for thatching and clamping. Possibly the straw used for thatching and clamping may even find its way eventually into the stock yards and be thus put to a double use.

In regard to tail corn, estimates suggest that 2 to 3 bushels per acre may be left from a normal crop. The 50 acres of cereals and pulse can therefore be expected to provide up to 19 quarters, or approximately 4 tons of low quality concentrated food. The amount of food obtainable from stubble pickings is less easy to assess, but it does not seem unreasonable to assume that 1 acre of stubbles might keep 100 head of poultry for two days. On this basis, and allowing 4 oz. of grain per day for a mature bird, these stubble pickings can be reckoned to provide about 1 bushel per acre, or a total of at least 1 ton of poultry corn.

From the root shift, there will be available 8 acres of beet tops, and chat potatoes from 2 acres. In regard to the former it seems to be generally accepted that 1 acre of tops is equal in feeding value to 5 tons of mangolds, so that here is a potential supply of stock food equivalent to 40 tons of roots. From the potato acreage about 2 tons of chats may be available.

The aftermath of the "seeds" hay must be considered separately from that of the meadow hay. The seeds area consists of mixtures and "straight" clovers in about equal proportions. Somewhere about 10 per cent. of the former and 40 per cent. of the latter are cut twice in one season, and as these second cuts can hardly be considered as by-products in the sense in which we are using the word, the seeds aftermath available for stock grazing must be reckoned as covering only 60 per cent. of the clovers and 90 per cent. of the mixtures. But in practice half the clover aftermath and a quarter of the mixture aftermath is ploughed up without being grazed, so that, roughly speaking, grazing for livestock is available on only half the total seeds area. On our "representative" farm this will amount to 8 acres of aftermath, which may give the equivalent of one month's keep to one "animal unit" per acre. The aftermath from

the meadow hay acreage can be assessed on a similar basis, so that a total of approximately nineteen "animal units" should be kept for one month on this by-product.

The formal economist will frown severely on any attempt to place a money value on the items which have just been enumerated, for by-products have no "supply price," while if they are valued on a "replacement" basis a false assumption is introduced. But let us imagine an absurd example of some farmer (not, in this case, "representative"!) who, while maintaining the organization outlined in Table VI., resolutely refuses to use his own by-products, and purchases identical material from his neighbours. His bill for these purchases might reasonably be itemized as follows :—

	£
240 loads of dung at 5s.	60
700 gallons of skim milk at 2d.	6
20 tons of thatching and feeding straw at £1	20
4 tons of tail corn at £3½	14
1 ton of poultry grain at £5	5
40 tons of mangolds at 10s.	20
2 tons of chat potatoes at £1	2
Aftermath grazing for 19 neatstock at 8s.	7½
Total	£134½

This expenditure will add approximately £1 per acre (13 per cent.) to costs, and so will absorb the entire cash profit which might normally be expected. It is of interest to note that the value of the livestock by-products is almost exactly half the total, although this is no doubt merely a coincidence.

But however ridiculous it may be to attempt to place a value on these by-products, it is obvious that the quantities available are very considerable. It seems clear that their very existence is partly responsible for the farmer's organization, for he could not afford to maintain his scale of production if he had to purchase equivalent feeding and manurial material. It is in directions such as this that we must seek the explanation of the seeming ability of arable farmers successfully to compete with grass farmers in, say, winter milk production, of the sideline poultry keeper being able to undercut the commercial specialist, and of crops being grown year after year in spite of the fact that their "apparent" cost exceeds the price which they realize.

Let us examine now the second characteristic advantage of mixed husbandry to which reference was made at the beginning of this article, namely the way in which it spreads the demand for labour and equipment throughout the year. Most types of agricultural production, particularly crop production, are of a seasonal nature, and cannot be organized in the same routine

way as factory production. The soil requires ploughing, but it must be ploughed at the right time. This implies that instead of being able to keep one plough fully employed all through the year, the farmer must have two, three, or four ploughs and use them all together during six, four or three months of the year. As a plough will not propel or guide itself, horses and drivers must be kept in proportion to the number of ploughs. Other things being equal, two ploughs at work for six months will be less expensive than three ploughs for four months, and the same conditions arise with most forms of ordinary farm equipment. But as different agricultural products exert their demands on labour, power, and equipment at different seasons, the effective working period of these agents can be extended by producing more than one commodity. Let us glance at a few illustrations referring to conditions in the Eastern Counties.

The traditional Norfolk four-course rotation was based on a division of the arable area into four quarters, of which one was cropped with winter corn, one with spring corn, one with fodder roots, and one with temporary grass or clover for hay. At the termination of the cereal harvest in September, ploughing and sowing for the next season's wheat would be commenced. This was followed by the mangold harvest, while threshing and dung carting, together with bullock tending, would keep men and horses occupied until the turn of the year. Preparatory cultivations for the spring corn and roots would be put in hand early in the new calendar year, and after these had been drilled, inter-cultivations and hand hoeing would proceed until hay-making in June marked the last stage before the commencement of the next cereal harvest.

It is true that in recent years considerable modifications have been made in the traditional Norfolk organization. More winter corn is now sown, sugar beet and other cash fallow crops

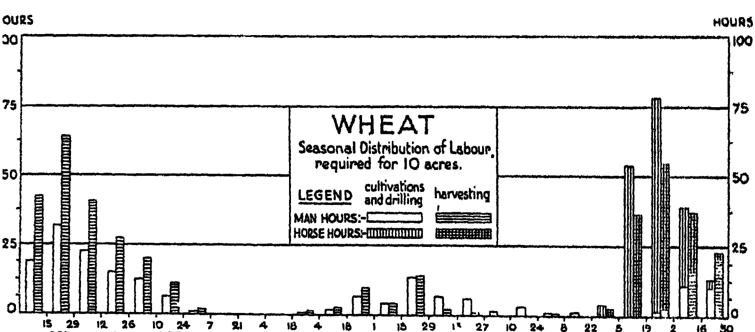

FIG. 1.—Seasonal distribution of labour requirements of Wheat Crop.

are replacing mangolds, the seeds area has been contracted, while dairy cows and poultry have been substituted for bullocks. These modifications have been brought about partly as a result of changing price levels and partly as a result of mechanical inventions (*e.g.* the tractor) increasing the speed with which critical operations may be carried out. But the underlying principle is still the same, for with the relative rise in wages, the need for effective application of labour is now even more important than formerly.

Figure 1 illustrates the seasonal nature of the demands on man and horse labour made by winter wheat in the Eastern Counties. It is clear that on a farm on which nothing but wheat was grown labour, management, and equipment would be idle for the greater part of the year. If modern large-scale machinery replaces horses and men, the effective working periods would be even shorter, and although the labour bill might be reduced the capital charges would be greater, and management costs would probably remain unchanged. It is true that even

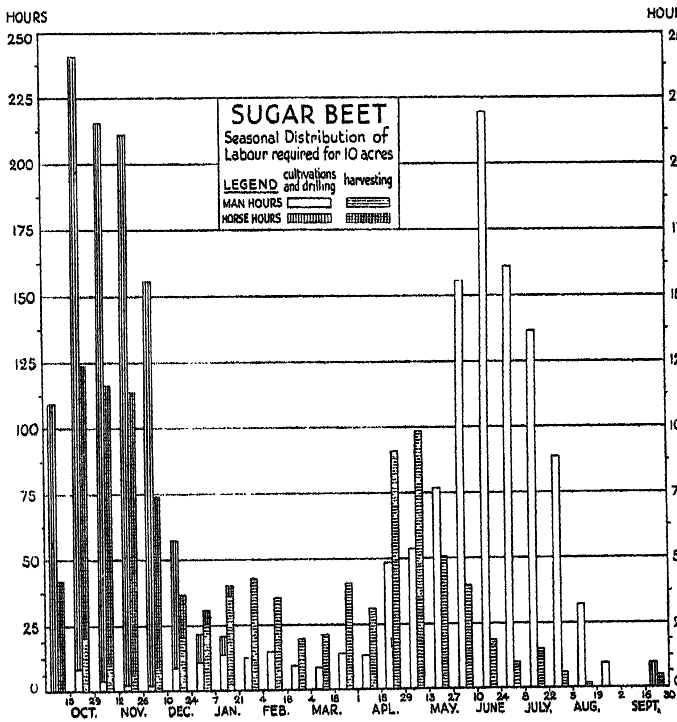

FIG. 2.—Seasonal distribution of labour requirements of Sugar Beet.

on a specialized wheat-growing farm the entire area will not be cropped each year, and that fallowing operations will fill up some of the gaps in the diagram. But if these necessary fallowing operations can be combined with some additional cash enterprise, the gross income of the farm may be increased without materially affecting the overhead charges. Figure 2 shows that sugar beet tends to fulfil these requirements on account of the heavy demands it makes on labour during the late autumn, spring and early summer months. A further increase in the effective labour periods can be made by substituting spring corn for part of the winter wheat area, and Figure 3 shows the seasonal requirements of spring oats. Lastly the gap between the termination of sugar beet hoeing and the

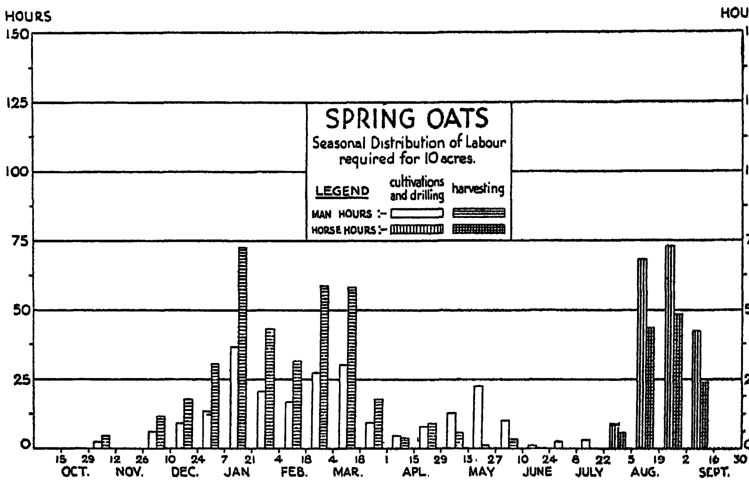

FIG. 3.—Seasonal distribution of labour requirements of Spring Oats.

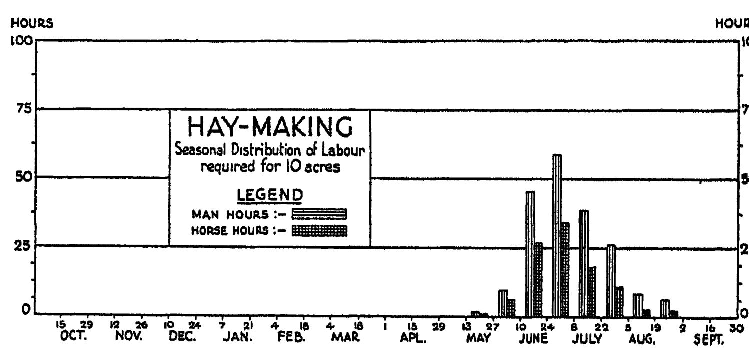

FIG. 4.—Seasonal distribution of labour requirements of Hay-making.

beginning of the cereal harvest may be effectively filled by hay-making, as is illustrated in Figure 4.

The combination of crops and livestock commonly produced on farms in the Eastern Counties (see Table VI.) results in a relatively level distribution of labour throughout the year. On a sample of farms on which this problem was carefully investigated[1] it was found that so far as man labour was concerned the total number of hours worked per fortnight ranged from only 16 per cent. below to 17 per cent. above the mean (see Figure 5). The range in the number of horse hours worked was

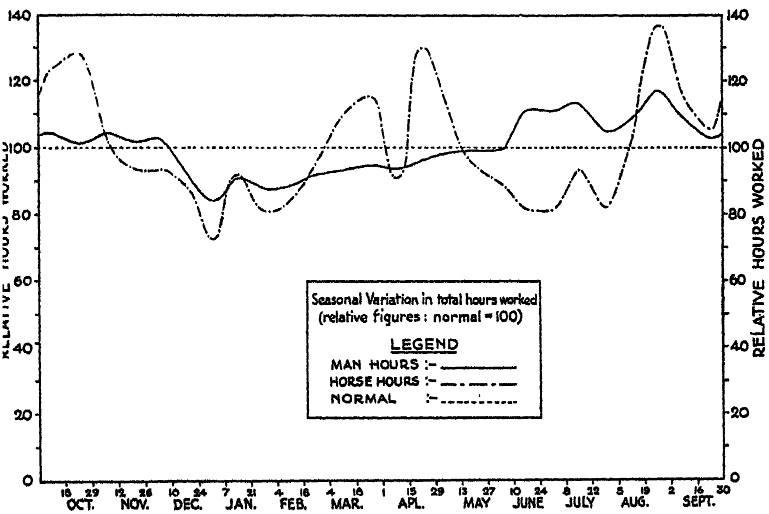

FIG. 5.—Seasonal variations in the total demand for manual and horse labour on mixed arable farms in the Eastern Counties.

somewhat greater, the comparable figures being from 26 per cent. below to 28 per cent. above the mean. The smallness of these variations in comparison with similar data from specialized crop-producing regions (such as the wheat areas of Dakota or Western Australia), suggest that under diversified methods, the length of the effective period of application for labour and capital must compensate to a certain extent for the absence of the advantages associated with specialized large-scale methods.

The third feature of mixed husbandry, and the last to which reference will here be made, is the advantage it provides in the matter of distributing the farmer's income throughout the year. Perishable products must be sold as they are produced, and even though, say, potatoes or sugar beet can be stored for a time, there is a definite and comparatively short limit to that

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1 See Cambridge University Farm Economics Branch *Report* 14.

time. Reference to the Corn Act Returns shows that nearly nine-tenths of the corn sales occur during the seven months September to March. Grassland dairying, beef and lamb production are also of a seasonal nature, while individual fruits and market-garden crops have a comparatively short sale period.

The financing of a business is always facilitated when income and expenditure take place concurrently. The difficulties even amongst the occupiers of mixed farms towards the end of harvest, when income has lagged behind expenditure only for a few months, give some idea of the greater embarrassment which must be experienced by producers with a less constant revenue. The monthly milk cheque obtained by arable milk producers is welcomed almost as much for its regularity as for its amount. Not the least advantage of poultry and pigs is that they can be made to provide a fairly regular income throughout the year. Regularity of income is all the more important in businesses such as farming, where standing charges must be incurred throughout the year even in those periods when direct productive activity is at a low ebb.

The monthly variations in income and expenditure on eight Eastern Counties' farms are plotted in Figure 6. The

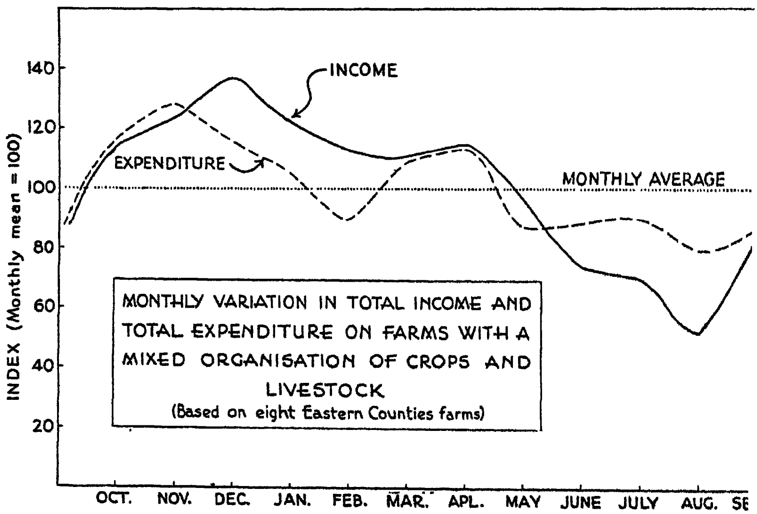

FIG. 6.—Seasonal variations in the total income and total expenditure on mixed arable farms in the Eastern Counties.

organization of these farms corresponds in general to that outlined in Table VI., and on none is there a single month of the year in which either income or expenditure is zero. Figure 6

shows that income fluctuates more widely than does expenditure, but except for the three months June, July and August, variations in income run approximately parallel with variations in expenditure. Income is over the average in seven months of the year, of which November, December and January represent the peak at 25-40 per cent. above the monthly mean. The nadir of income is during hay-time and harvest, when it falls to 30-50 per cent. below the monthly mean.

Expenditure is above the average in six months of the year, the characteristic peaks in autumn and spring corresponding with half-yearly rent payments, purchases of fodder, fertilizers, and seed. It would appear as if certain major autumn disbursements are postponed for about a month beyond the customary quarter day, as a result of the need to await some accumulation of income from sales of the current year's crops. Over the whole year, however, variations in monthly expenditure do not seem to fluctuate much outside the limits of from 20 per cent. below to 30 per cent. above the mean.

In conclusion it may be said that while larger units and increased mechanization are no doubt desirable directions for agricultural development from the economic point of view, such tendencies are not synonymous with specialization in the sense in which the word has been used in this article. It is true that special circumstances of soil or situation may give a monopoly advantage to limited numbers of producers of certain commodities, or in other cases may reduce the opportunities for diversification. But these particular examples must not be made the basis for generalizations. In a contribution to *World Agriculture*[1], Professor Karl Brandt emphasizes the advantages of mixed farming by stating that "there is no proof that the American wheat farmer in Kansas is really able to produce wheat at a cheaper rate than the European peasant farmer. The latter produces all kinds of grain as by-products in the range of many other products, and has a very different criterion of costs, because work is well distributed all the year round and because manuring utilizes another by-product." In recent years Russia has provided a practical demonstration that the "rationalization" of agriculture does not yield the results which, on an industrial parallel, might be expected. The gigantic State farms set up under the first Five Year Plan, to be developed on the factory principle along specialized lines under "expert" management, have from all accounts not proved satisfactory. It appears that recent modifications have tended towards sub-division of these large units, and the adoption of more diversified systems

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[1] Report by Study Group of Royal Institute of International Affairs. Oxford University Press.

of husbandry. This reversal of policy in the Soviet Union suggests that the advantages of mixed husbandry are not confined to a capitalistic society, in which the rights of the private owner may conflict with the interests of the community, but rather that they are inherent.

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SOME CHEMICAL METHODS OF WEED DESTRUCTION.

UP to the end of last century the successful destruction of weeds depended upon the skill of the farmer or gardener in his methods of management, and upon the manner and frequency of use of his tillage implements of various types. In spite of modern research, mechanical means are still the most common and important aid to weed destruction. As Sir Daniel Hall has said (Ref. 1), " Whatever measure of success may attend the chemical treatment of weeds, and it is considerable, it can never absolve the farmer from the traditional system of cleaning the land by well-timed cultivations under the rotations that are followed." This is a sound dictum, because, apart from weed destruction itself, successful raising of crops depends upon thorough cultivation, tilth, aeration and free permeation of moisture.

It is a notable fact that most farmers remain true to the old traditions, the old methods and the old machinery—the plough, the scarifier, the harrows, the hoe, in their modern forms—with, on some land, regular or occasional bare fallowing. There is, of course, every reason why all such means should be continued, because of their direct association with the successful growth of crops, as indicated above—though there are doubtless still some farmers who might fail to carry them out unless induced to do so by rapidly-growing weeds! As to this, it may not be out of place to note the fact that the Corn Production Acts (Repeal) Act, 1921, gives to the Minister of Agriculture powers—delegated to County Agricultural Committees—to require the occupier of any land to destroy any scheduled weeds growing upon the land. The scheduled weeds are Spear Thistle, Creeping Thistle, Curled Dock, Broad-leaved Dock and Ragwort. The number of cases dealt with has increased steadily since the Act was passed, and reached 6,823 in 1932, 7,078 in 1933 and 6,961 in 1934. In 1933, 6,601 cases were dealt with by arrangement, and 477 notices were

served; there were thirteen prosecutions, all of which were successful.

Notwithstanding the value of mechanical means, there are times and circumstances when some non-mechanical and labour-saving means of weed destruction would be highly valuable. Last year, for example, one of us (H.C.L.) treated a cinder path with a solution of copper sulphate, and it remained, substantially free from weeds for six months or more. Research and experimental work, and many demonstrations on farms, have clearly shown that "chemical destruction" of weeds may very usefully be practised in association with the normal tillage operations, either before or after them.

In the early part of 1934 was published a brochure (Ref. 1) in which an attempt was made to review and summarize the work done up to that time in relation to the suppression of weeds by fertilizers and chemicals. It is not intended here to cover the same ground, but to supplement the information therein given, by noting more recent work, and, in particular, by including some account of the machinery necessary for chemical weed destruction on the farm. It is hoped that this "addendum," as it were, will have the effect of enlarging the growing army of farmers who are already using one or more of the chemical methods discussed.

Apart from fertilizers that are in use for growing farm crops, there are many chemicals that can be used successfully for weed destruction, according to circumstances. Some of the fertilizers need not be discussed here, as they are for the moment adequately covered, but it will be necessary to say something about calcium cyanamide. Of the chemicals proper, the most widely used at present appears to be sulphuric acid, though we have no information of the area sprayed with copper sulphate. There are, however, other products that have been widely tested and that may prove of considerable value, as they show much promise. The sulphates of copper and iron came into use for destroying Charlock in corn crops, before any other chemicals, but their use is well established (Ref. 2), and further reference to them here is unnecessary. Chlorates are extensively used in proprietary weed-killers, and as pure chemicals have given successful results in many parts of the world. Ammonium thiocyanate (or sulphocyanide) has been under trial for many years, and in particular has shown promise in New Zealand in relation to the destruction of Ragwort (one of our scheduled weed species). It is, therefore, proposed to give a brief additional account of weed destruction by sulphuric acid, calcium cyanamide, chlorates and ammonium thiocyanate.

Sulphuric Acid.—During the past five years the increase in the use of sulphuric acid, for destroying weeds in corn crops,

has undoubtedly been a marked feature of arable farming, the area sprayed having risen from a few hundred acres to 5,570 acres in 1933, 20,132 acres in 1934 and 29,000 acres in 1935. In this connection it may be observed that in France, the home of spraying with sulphuric acid, about 500,000 acres were treated in 1933 (later figures are not available). It deserves to be mentioned also that in recent years spraying with sulphuric acid has been taken up very keenly in the United States of America. In California, Dr. W. W. Robbins has conducted extensive trials, and during the past season commercial spraying has also been carried out on a very large scale.

During the past two years, trials have also been made in relation to the destruction of potato haulm and the weeds contained in the potato crop, in order to ensure the quick ripening of the tubers and to make lifting easier, while at the same time reducing the incidence of late Blight and the prevalence of weeds. Much work on the machines for use in spraying has been done through the Institute for Research in Agricultural Engineering, Oxford, and some account of such machinery is given below.

As regards potato haulm a report by Bates and Martin (Ref. 3) states that the trials described show that "even when the incidence of Blight is slight, spraying at the proper moment with dilute sulphuric acid reduced the loss of 'ware,' incurred through a late attack of Blight, to a minimum." The experiment took place at King's Lynn in September, 1934; the strengths of solution were 10 per cent. and 20 per cent., and the quantity 100 gal. per acre; the spraying stopped growth three weeks before the normal time of lifting; the total yield was not affected; the proportion of "blights" to "ware" was reduced on the sprayed plots; the costings showed that the treatment was justified; and in addition there were considerable advantages in destroying the haulm and weeds. Some 3,500 acres of potatoes were treated in this way in 1934, apparently with entirely satisfactory results.

Trials by Bates (Ref. 4) at King's Lynn in November, 1933, and November, 1934, tested the value of spraying bulb crops with a 10 per cent. solution of sulphuric acid at the rate of 80 gal. per acre. On the sprayed areas there was complete control of weeds in 1933, whereas unsprayed parts of the crop were choked with weeds, especially Chickweed, though Sow Thistle (*Sonchus oleraceus*) and Groundsel were fairly abundant. Success was less pronounced in 1934, because the weeds were constantly wet with rain or dew; a 10 per cent. solution was ineffective, and a 20 per cent. solution not completely effective, though it did check the growth of weeds. The bulbs (tulips) suffered no

damage. It was held that the success of the treatment is dependent upon weather conditions at the time of spraying.

In France, weed destruction with the aid of sulphuric acid is carried on most energetically, and the procedures recommended by Rabaté, Carré and others are widely practised.[1] Preliminary work with sulphuric acid was carried out twenty-five to thirty years ago, or more, but serious experimental work began after the Great War, and the process came to be widely adopted owing to the energy shown by M. Rabaté (who was Inspector General of Agriculture) in prosecuting a war on weeds by every possible means.

It is observed that the progress of development was that M. Rabaté urged the necessity of eradicating weeds; the

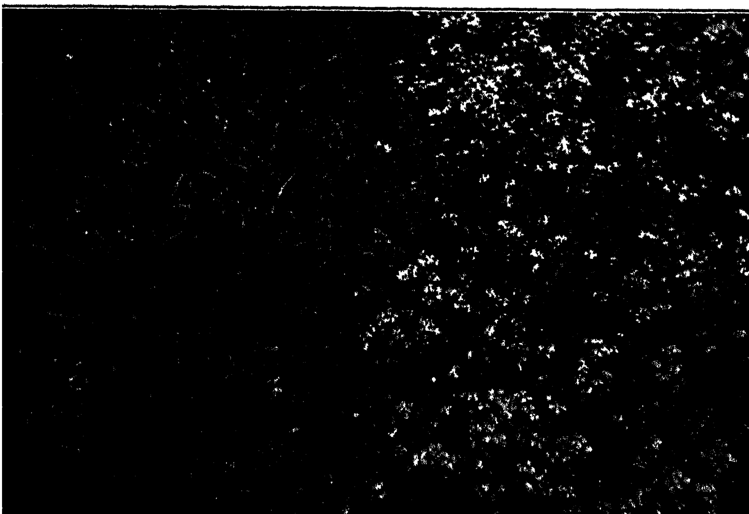

FIG. 1.—Sulphuric Acid Spraying of Oats. (Untreated plot on right.)
(*Photo R. K. MacDowall.*)

Implement Manufacturers took up the matter and produced suitable machines, issued propaganda and gave the lead by holding demonstrations and by doing contract work; and lastly the village syndicates or associations and the big farmers followed suit and gradually began to purchase their own machines, until to-day the greater proportion of the spraying is done by the farmer himself or by the syndicates. The larger

[1] The writers wish to express their indebtedness to the National Sulphuric Acid Association for permitting the inclusion here of notes on a report of a visit to France by Mr. L. D. Martin, who conducted an enquiry on behalf of the Association in November, 1934.

farmers often spray for the small men, after they have finished their own spraying, not by contract but by some verbal agreement. (Such co-operation might well follow in Great Britain, and indeed one instance of joint effort is mentioned later in this paper). French sulphuric acid makers do not carry out spraying, but do much to encourage it by general propaganda against weeds.

In the last two or three years the use of sulphuric acid has slightly decreased in France as the seasons have been so dry that weeds have been less prevalent, and apart from there being less need to spray, cyanamide, copper sulphate, and kainit have been more generally used, as being easier to handle. When normal or wet seasons come again there is every prospect of a return to sulphuric acid spraying, as it is quite successful during damp (though not, of course, during continuous wet) weather.

Spraying to destroy potato haulm is not practised in France, but one farmer risked spraying his potatoes in June, 1934, with a 9 per cent. solution of sulphuric acid (strength of acid not stated, but probably 65 deg. Baumé) to kill Charlock at the expense of the crop. All vegetation was killed to the ground, but after rain the potatoes grew again and eventually yielded a bumper crop. One would, however, hesitate to repeat such an experiment except on a small scale. In general, French practice corresponds very closely with that prevalent in this country.

One French contractor has found it to his advantage to do spraying, apart from the contract work itself, since the increased yields obtained are of advantage to him because he undertakes most of the threshing! The extension of spraying in other countries is indicated by a recent statement that one French firm had just completed an order for 500 spraying machines for Russia.

This note on sulphuric acid spraying may well be concluded by quoting the following abstract from the Ministry's Advisory Leaflet (Ref. 2):

> "Spraying with copper sulphate is now being rapidly replaced by spraying with a solution of sulphuric acid. This method possesses certain advantages, as it is quickly effective, is much less affected by rain following, and destroys many other weeds besides Charlock, while it does no permanent injury to the cereal. The strength of solution to use varies somewhat with circumstances, lying between 7 and 15 per cent. Carboys of acid of recognized strength are obtainable; a special type of sprayer is necessary; the method can readily be learned by farmers and their employees; the work can be arranged for by contract; and the cost lies between 10*s*. and 20*s*. per acre, according to circumstances. The method is certainly the most effective

of the 'wet spray' methods of destroying Charlock, and with reasonable care is entirely 'safe'."

It must be emphasized that many other weeds besides Charlock are destroyed by spraying with sulphuric acid (Fig.1).

Dusting with Calcium Cyanamide.—The experimental work already detailed in Reference 1, shows very clearly the efficacy of calcium cyanamide as a weed-killer, apart from its manurial value. Additional trials in the last year or so have served to confirm earlier results, but there are a few further facts of some interest. Cyanamide is becoming more widely used for the combined purposes of nitrogenous top-dressing and the destruction of Charlock and other annual weeds (Figs. 2 and 3), and it must be regarded as of particular value in cases where the crop needs a nitrogen stimulant. When a nitrogenous fertilizer is not necessary, or might make the cereal go down, it is better to depend upon sulphuric acid spraying.

In Scandinavia and Holland cyanamide is extensively used, and in the latter country a great many trials have taken place. The material is in the form of a very fine powder, somewhat resembling basic slag, and such powders need particularly good and even application. This point is touched upon later in this paper.

At Bremen (Ref. 5) a mixture of four parts of finely-ground kainit to one part of cyanamide, at the rate of 4 cwt. of the mixture per acre, has been found very satisfactory against Cornflower and Silky *Agrostis* (*A. spica-venti*) in winter rye, both species being very plentiful on certain light soils in different parts of the Continent. Cyanamide alone, at the rate of about 1½ cwt. per acre, was found equally effective. Autumn dressings were preferable, the weeds then being, in general, more susceptible, though in some instances spring dressings gave better results.

In one trial (Ref. 6) the use of cyanamide at the rate of 4 cwt. per acre effected a considerable reduction of Rushes, when applied in July after they had been closely cut.

Asparagus seems to be so little subject to injury by cyanamide that asparagus beds may be heavily dressed without injury to the crop, but with certain destruction of the weeds. At Kirton, (Ref. 7) applications were made in quantities varying from 1 to 10 cwt. per acre on April 28, 1934, when the growth of the asparagus was beginning. The quantity of 1 cwt. was ineffective, 3 cwt. gave partial control of weeds, but 6 cwt. and 10 cwt. gave complete control of the weeds, and this continued for a period that would have been one cutting season for a fully established crop. Similar results have been obtained in the United States of America.

Though for most weeds early spring application is essential, it would seem that Poppies are best destroyed when the rosettes

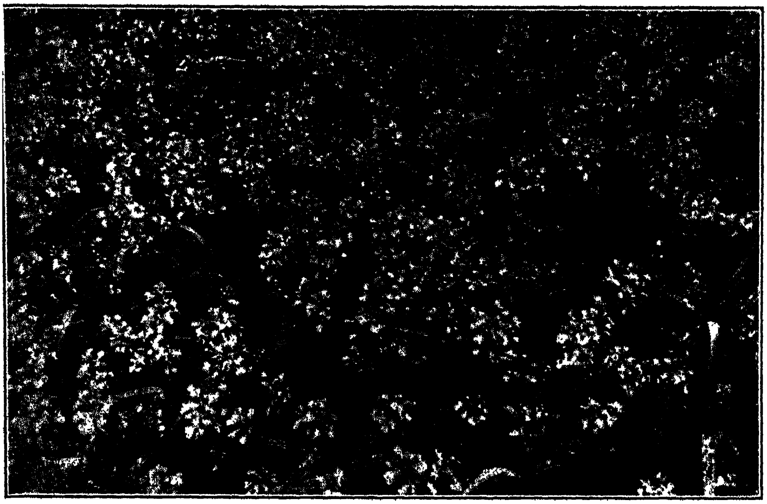

Fig. 2.—Oats infested with Charlock (Nitrogen applied, but not as cyanamide)
(*Photo kindly lent by Messrs. Shaw, Scott & Co.*)

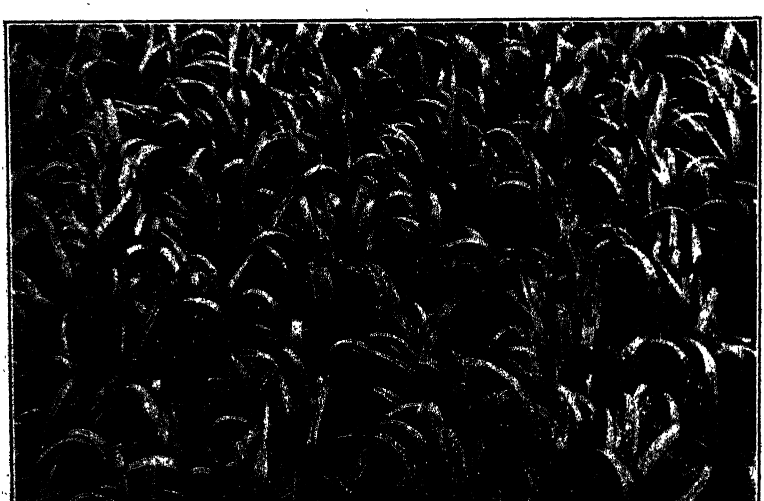

Fig. 3.—Oats infested with Charlock (as in Fig. 2), after treatment with 2½ cwt. Cyanamide per acre.
(*Photo kindly lent by Messrs. Shaw, Scott & Co.*)

are the size of the palm of the hand. It has been suggested that this is due to the presence of tender young leaves in the centre of the rosette, these being formed when the established seedlings start active growth in spring.

It further deserves to be noted that, according to some experimental work, better results are obtained in weed destruction in cereal crops if the crop is well rolled before the cyanamide is applied. The rolling bruises or injures the rather brittle, tender and soft-skinned weeds much more than the cereal, and so makes the weeds more susceptible to the cyanamide. It is clear, however, that the cereal must not be rolled when it is too far advanced—and in any event the weeds, especially Charlock, are best treated when no more than 3 or 4 in. high.

About August, 1934, one of us (H.C.L.) treated a considerable number of Dwarf Thistles with cyanamide, sulphate of ammonia, sodium chlorate and ammonium thiocyanate respectively. The procedure was to place a small quantity, with the fingers, on the centre of individual plants, a little between thumb and two fingers serving for several plants. This meant that treatment could be effected at some speed, but the method would only be practicable in special circumstances. The results with all four materials were sufficiently striking, many plants that were lifted a few weeks later being completely killed, the rootstocks being dry and dead.

Sodium Chlorate.—As we have already indicated, chlorates, and in particular sodium chlorate, are widely used in the preparation of proprietary weed-killers, and there can be no doubt that for gravel and cinder paths, drives and vacant spaces, an application of sodium chlorate, as a 10 or 15 per cent. solution at the rate of 100 gal. per acre (*i.e.* 100 to 150 lb. in 100 gal. of water) will destroy most weeds in such situations. A heavier dressing would be necessary to kill some perennials, such as Couch grass, Docks, Bindweed, Creeping Thistle, and perhaps Dandelions. When arable land can be left free of crop for a period of four to six months, as from autumn to early spring, it may be given a fairly heavy dressing—say 1½ to 2 cwt. per acre, either as a spray in two applications, or as a powder dressing if it can be really evenly distributed.

Herefordshire trials showed (Ref. 8) that when 2 cwt. of sodium chlorate were applied at the end of October—either broadcast or in solution—in association with usual cultural operations, on land of which 91 per cent. was occupied by weeds, the remaining 9 per cent. being bare ground, it brought about the eradication of Couch grass, Creeping Bent and Crowfoot, as well as all the shallow-rooted annuals.

Trials in Scotland in 1933 (Ref. 9), on a couch-infested stubble, also gave satisfactory results. Sodium chlorate was applied in two equal sprayings in October and early December, totalling 1½ cwt. per acre. It was applied in such a way as to saturate both sides of the furrow. Turnips were drilled in May, 1934, and no harmful effects on germination were noted.

Cleaning was not necessary on the treated area, "whereas on adjoining ground Couch was in vigorous growth and three coats of weeds had to be removed" at an estimated cost of 32*s*. per acre. It is observed that "It is pretty certain also that sodium chlorate at a moderate price will provide a complete solution to the Couch-grass problem in ordinary farm practice."

It is not sufficiently recognized that Bracken is in some districts a serious menace. Far too little is being done to reduce it, where it is a pest, or to prevent its extension—and the area which it occupies may well increase steadily unless it is seriously attacked. It is all to the good, therefore, that in 1934 a trial (Ref. 10) was made at the College Farm, Bangor, to destroy Bracken with sodium chlorate. On April 26, plots were treated with 2 cwt. and 1 cwt. per acre respectively, and were sown with clover and grass seeds four months later, after a total rainfall of 16 in., without any trace of subsequent injury. It was held that a dressing of 2 cwt. per acre was effective, but that, at 35*s*. per cwt., the cost of the chlorate was too high.

Experiments in the United States (Ref. 11) "led to the conclusion that an application of 100 lb. of sodium chlorate per acre would cease to be toxic after 131 days; 200 lb. after 237 days; 400 lb. not until after about a year; and 800 lb. not until very nearly, if not quite, two years.

It would be of interest to discover a real means of destroying Hoary Pepperwort (*Lepidium draba* L.), described by Sir Rowland Biffen some years ago as a weed menace in the Eastern Counties. Experiments in the United States (Ref. 12) showed that complete eradication of this weed can be obtained by two applications of sodium or calcium chlorate at the rate of 160 lb. per acre for the first application, and 640 lb. per acre for the second application ten days later. Such heavy doses, however, must be regarded as greatly too costly for use on any but small areas of valuable land, while the effect on following crops is uncertain (*cf.* experiment next above).

A trial (Ref. 13) comparing tillage and chlorates for destroying Field Bindweed, Creeping Thistle and Perennial Sow Thistle showed that "tillage, except for treatments delayed until bloom, was more effective and cost materially less than chlorates." On a costings basis "the more effective chlorate treatments cost from four to eight times more than the better tillage treatments." The Bindweed was more readily killed by chlorates than were the other two species of weeds.

In a paper dealing with Field Bindweed (Ref. 14) it is observed that for average conditions 400 to 480 lb. per acre would be suitable for a first application, which, with the necessary follow-up treatment, would be likely to make a total requirement

of 450 to 650 lb. per acre. This again would be very costly treatment. Autumn treatment is especially advocated. It is stated that the quantity of chlorate needed varies with the fertility of the land, more being required on fertile soils ; while the material acts more quickly in loose, sandy than in heavy soils.

In other U.S.A. trials (Ref. 15) it was found that when 400 lb. of sodium chlorate were applied in two treatments, or 350 lb. in three treatments, all the plants were killed.

Preliminary experiments in Tunis (Ref. 16) with cereals suggested that cereals were more resistant to a sodium chlorate spray than annual weeds. The spray used was a 1 per cent. solution, only about 10½ lb. of chlorate being used per acre, or say 10 lb. in 100 gal. This apparently constituted a selective weedicide that was easier to use and much less costly than sulphuric acid. Somewhat similar conclusions were reached by Fron and Bertrand in France. Further trials, however, were not very successful, and it is clear that further work on similar lines is necessary before advice can be given.

Further trials in France (Ref. 17) were conducted in 1934 to destroy Lesser Celandine in wheat. At the rate of 10 lb. in 100 gal. per acre, applied on April 19, the treatment led to the complete destruction of the weed, including the rootstocks, in six weeks. The cereal, however, suffered a severe set-back, and the yield was ultimately only 70 per cent. of that of the control plot and only 55 per cent. of that of a plot treated with cyanamide.

As indicated earlier in this paper, sodium chlorate completely killed the Dwarf Thistle, including its deep-seated rootstocks, in grass land in August, 1934.

Trials conducted in Wiltshire (Ref. 18) showed that Nettles could be eradicated by scything over in May and treating with 70 to 100 lb. of sodium chlorate, dry or in solution. For paths 0·5 to 0·75 oz. per sq. yd., dry or in solution, may be used. A heavier dressing in late May gave complete clearance from weeds until September.

In Scotland (Ref. 19) Bracken was withered and dead a few days after treatment with 80 gal. of a 1 per cent. solution of sodium chlorate (8 lb. in 80 gal.). Another investigator recommended, on the basis of three years' trials, that Bracken should be dressed for two or three years with dry sodium chlorate at the rate of not less than 1 cwt. per acre per annum.

Tincker concluded (Ref. 20) that the following solutions of sodium chlorate have been found satisfactory for the purposes stated, at the rate of 1 gal. to 10 sq. yd. :—

10 per cent. sol. (1 lb. in 1 gal.)—To kill deep-rooted weeds, shrubs and rank grass.

5 per cent. sol.—To kill large weeds; grass in paths.
2½ per cent. sol.—To kill small weeds, annuals, and for use on lawns.

He adds that it has been found possible to kill Ragwort, Bracken, Creeping Thistle, Annual and Great Stinging Nettles in pastures by using a 1 or 2 per cent. solution, without serious injury to the grass.

Trials in Scotland (Ref 21) with a 1 per cent. solution of sodium chlorate to destroy Charlock in corn crops checked Runch, or White Charlock, but more or less severely checked the cereal. The use of sodium chlorate as a spray against annual weeds in cornfields "cannot be recommended."

It should here be added that sodium chlorate must be used with great care, owing to what is often termed the "fire hazard." If sodium chlorate solution dries on clothing, sacks or other fibrous materials these are rendered highly inflammable, and it is most important that clothing (including boots) that may have been wetted in the course of applying the solution should be washed immediately. If this is not done, a match used to light a pipe or cigarette—or these themselves—may cause a bad accident. Even boots that have dried after a wetting have been known to blaze up when feet were being warmed by a fire. For these reasons it is desirable to wear overalls and rubber knee-boots when distributing sodium chlorate solution.

Ammonium Thiocyanate.—This substance has been widely tested overseas and has proved of much value for destroying certain weeds. In the past year small trials have been made in various parts of England and, as indicated earlier in this paper, it was found in 1934 to be quite effective in destroying Dwarf Thistle. Similar hand treatment of Plantains, Daisies and Cat's-ear on a lawn resulted in the weeds being killed, though the grass was also badly scorched.

As regards the toxicity of the material to crops sown after its use, trials in the United States (Ref. 11) showed that the period of sterility was very short. When it was applied at a rate equal to 100 lb. per acre there was no period of sterility, and even at 800 lb. per acre there was marked stimulation of growth after sixty-nine days. It was concluded that ammonium thiocyanate is rapidly decomposed—that its rate of decomposition "must, in fact, be surprisingly rapid, since the salt itself is, weight for weight, much more toxic to the higher plants than sodium chlorate."

There can be little doubt that if ammonium thiocyanate were obtainable at the right price—as it probably will be if the demand increases—it might become exceedingly useful as a weed-killer having a high subsequent value as a nitrogenous fertilizer—estimated at 1¼*d.* per lb. of thiocyanate,

based on the present price of sulphate of ammonia, or according to the Rothamsted Experiments at 2*d*. per lb. of ammonium thiocyanate based on the New Zealand price of sulphate of ammonia (Ref. 22). On first application it is very toxic to vegetation; it is readily soluble in water and is, indeed, hygroscopic; it is not inflammable; it will not injure the skin of the person who applies it, and is substantially non-poisonous; finally it decomposes rapidly in the soil—say in two or three weeks—providing available nitrogen for the use of the crop to be grown.

It is therefore suggested that ammonium thiocyanate may be used as a spray to kill weeds on land under bare fallow, or on arable land generally where sowing of seed is not to take place within about a month. Before decomposition it will destroy foliage and stems, and when washed into the soil will kill roots. Isolated weeds may be destroyed by the application of a "pinch" to a teaspoonful, according to size, before (Stemless Thistle, Dandelion) or after (Burdock, Dock) cutting off the weed at the surface of the ground.

Ammonium thiocyanate may also be useful in the autumn for destroying weeds on areas of bulbs, when deep hoeing or other tillage operations might cause damage to the growing points of the bulbs below-ground; such injury would be avoided by the use of the thiocyanate, and the nitrogen contained would subsequently be utilized by the bulbs. The material might similarly be useful to reduce weeds in potato fields before the crop is lifted; it would not only destroy the weeds but make lifting much easier.

It has been found in New Zealand (Ref. 22) that 2½, 5 and 10 per cent. solutions, used at the rate of 200 gal. per acre against Ragwort, gave 80, 80 and 100 per cent. kills respectively. At the end of nine weeks the treated pasture, following light rains, was green, short and in good condition, while that in untreated areas was dry, coarse and rank. At 2½ per cent. the cost was 25*s*. per acre for materials (or 50 lb. at 6*d*. per lb.).[1] When used against weeds on lawns and garden paths in New Zealand the substance gave results that were regarded as very encouraging.

It is understood that the Manchester Oxide Company has been carrying out extensive experimental work on the use of ammonium sulphocyanide as a weed-killer in conjunction with County Council Organizers and Agricultural Institutes, but they are as yet not in a position to make any didactic statements as to its possiblities, although the position is fairly hopeful.

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[1] For a quantity the cost would probably be no more than 6*d*. per lb., 1½*d*. of which could be regarded as the value of the contained nitrogen

Machinery for Distribution of Materials.

Most wet and dry chemical materials for weed destruction have the common drawback that entirely suitable machinery for applying them seldom forms part of the ordinary equipment of the farm. Distributors for artificial manures may be used for applying dry powders to weed-infested corn, sometimes with fair success, but the destruction of weeds is apt to be irregular. The only machines of this kind that can be satisfactorily used are those that are capable of giving great—one might almost say unusual—uniformity of distribution when applying light dressings of between 1 and 2 cwt. per acre.

If we neglect the local application of chemicals to individual weeds, which is usually a simple procedure, the special requirements of machines for applying liquids or powders can be defined. Uniformity of distribution is the first essential, so that each and every unwanted plant may receive a sufficient number of particles to destroy it. As all wet and dry chemical "sprays" are to a lesser or greater extent dependent on fine weather conditions, and as the spraying season is generally of short duration, speed of application and freedom from stoppages are the next essential features. Other qualities, although secondary, are still of considerable importance, and one that is frequently overlooked is ease and cleanliness of handling caustic or corrosive chemicals, for poor work is often the result of chemical spraying being regarded, sometimes not undeservedly, as a job that is best over quickly.

Wet Spraying Equipment—Water Supply.—The first consideration in wet spraying is the provision of ample water—in such quantity that the spraying machine is able to work continuously. For different chemicals the water requirements vary from 50 to about 120 gal. per acre, but generally the tendency to-day is to spray at about 100 gal.

The rate at which water must be supplied to make possible the continuous operation of a sprayer will vary from 125 to nearly 300 gal. per hour. The lower figure applies to cart-attachment sprayers in which the pump is hand operated, while the larger rates of consumption are reached by tractor-drawn axle-driven sprayers and by power-driven machines. On an average, with a horse-drawn axle-driven sprayer, which is to-day most general, 200 gal. an hour will suffice.

The equipment for water supply is naturally dependent on local circumstances, and generally the inclusive cost of supplying water varies from 1*s.* 6*d.* to 2*s.* 6*d.* per acre.

Cart-Attachment Sprayers.—Liquid sprayers have developed considerably in the last three years, mainly owing to the great increase in the use of sulphuric acid. The development has

been chiefly directed towards increased capacity, both in acres per hour and output per man.

While the application of the sulphates of copper and iron, for the destruction of Charlock, has been carried out for several decades with cart-attachment sprayers having hand-operated pumps, the present tendency is towards self-contained units with axle-driven pumps. The newer types are of higher capital cost, but reduce manual labour, and for corrosive chemicals like sulphuric acid they are unquestionably cleaner and more suitable.

For sulphate of copper, however, the cart-attachment sprayer has in many instances rendered yeoman service, at a very low cost. The sprayer shown in Fig. 4 is now in its tenth year of operation, has averaged 65 acres each year, and is still in

FIG. 4.—Cart-attachment Sprayer for Sulphate of Copper.
(*Photo R. K. MacDowall.*)

regular use on a farm where conditions favour the use of this chemical, Charlock being recurrent in the spring corn, of which 75 per cent. is normally undersown with "seeds." With three men and two horses, for the machine and water cartage, the sprayer averages about 1·25 acres per hour for an application of 50 gal. per acre. The cost of spraying is 3*s.* 6*d.* per acre, excluding the cost of materials, while the sprayer's capital cost of £10 has long since been wiped off, the modest sum of 4*d.* per acre adequately covering a maintenance cost of 20*s.* a year.

Axle-driven Sprayers.—Axle-driven sprayers cost from about £42 to £67, exclusive of a filling pump. They are essentially simple, and consist of a barrel, a pump driven from the axle by cams or eccentric, with piping to a set of jets, fourteen to twenty-four in number, carried on a bar, the whole being mounted on a two-wheeled chassis. Barrels vary in capacity from 50 to 150 gal. and are constructed of wood or a copper alloy. Fifty-gallon barrels normally require filling every half acre, resulting in loss of time, while not materially reducing the cost of the sprayer. On the other hand, although it reduces the number of fillings, the 150 gal. size on an axle-driven machine always requires two horses. The 100 gal. size, however, can generally be drawn by a single horse, with easier driving and less damage when fairly high corn is being sprayed.

One of the most important features of these machines is their rate of working, which is closely related to the problem of avoiding rain interference; and this is not solely a question of width of the spray bar and the forward speed of the machine. Most machines cover a width of 4½ to 5½ yards and move, when horse-drawn, at about 2 m.p.h., covering from 3·3 to 4 acres per hour. This spraying rate may, however, be reduced, sometimes by as much as 50 per cent., by the idle time when the machine is being filled, when jets are being cleaned and when other stoppages occur. The time spent at the headland during filling is often excessive and is the most wasteful, as it is recurrent. This was shown by working two cycles of one acre, timed by a stopwatch, with a 100 gal. axle-driven sprayer. In cycle A the machine carried a hand-worked filling pump, supplied with the sprayer, having a capacity of 600 gal. per hour, while in cycle B a 1,500 gal. per hour hand-worked pump was fitted.

	Cycle A. Time in min. sec.	*Cycle B.* Time in min. sec.
Full machine departs headland	0·0	0·0
Spraying starts	0·30	0·10
Spraying stops	12·30	12·45
Empty machine returns headland . . .	13·00	13·45
Full machine departs headland	28·00	23·00

The sprayer during cycle A worked at a rate of $\frac{60}{28}$, or 2·14 acres per hour, and during cycle B at $\frac{60}{23} = 2{\cdot}6$ acres per hour. Neglecting small differences, the greater output during cycle B was obtained by a reduction of five minutes in the filling time, which increased the working rate of the sprayer by 21 per cent.

The use of larger filling pumps and piping will increase the capital cost of the machine by £5 to £10, and as these components

have an estimated working life of between 500 and 1,000 acres, the increased cost per acre to raise output will be of the order of 3*d*. While this greater working rate may necessitate an additional man, horse and water cart if water is not adjacent to the headland, the extra labour charge incurred will be more than cancelled by the increased output.

Consideration of the most direct methods of increasing the working rate of spraying machines involves the questions of the forward speed and the width covered by the jets. When horses

FIG. 5.—Handling of Corrosive Chemicals. Mixing of Sulphuric Acid inside the Spraying Machine.
(*Photo kindly lent by H. J. Hine, Esq.*).

are used a speed of 2 m.p.h. is more or less a maximum, but if horses are replaced by a tractor the speed can be doubled. There is here, however, little economic case for the tractor unless time is of great value, for an axle-driven sprayer at 3 to 4 m.p.h. has a draught of only some 300 lb., providing but a fraction of a load for an average tractor. On the question of the width covered by the jets, the problem of manipulating a machine with a wide spray bar becomes prominent, particularly if the land is ridge and furrow or hilly. One English firm has produced

a machine that probably represents the maximum in this latter direction, the spraying width being 25 ft. and giving, at 2 m.p.h., a net spraying rate (excluding filling) of over 6 acres per hour.

Handling of Chemicals and Preparation of Sprays.—The handling of chemicals under field conditions is sometimes left rather to chance and improvization. Solids, such as copper or iron sulphates or sodium chlorate, are easily prepared if the makers' instructions, to avoid iron and wooden vessels, are followed. Preparing sulphuric acid spray, however, requires some caution, as the general method of pouring strong acid from glass carboys weighing 200 lb. into open measuring

FIG. 6.—Power-driven Sprayer (Messrs. D. T. Gratton). Filling with Water and Acid in one operation.

(*Photo kindly lent by Messrs. D. T. Gratton & Sons.*)

and mixing vessels exposes the men to splashing and contact with the acid. A cleaner method (Ref. 23) is shown in Fig. 5, the contents of carboys being pumped direct into the machine and the solution being thus mixed under cover.

It has been suggested that diluting sulphuric acid direct in the barrel of the machine is likely to result in a spray of irregular strength, but if an effective paddle is provided there is no reason why mixing should be less efficient inside the sprayer than in open tubs. During the spraying of some 50 acres with the machine shown in Fig. 5 it was found that, in a mixing

time as low as forty-five seconds, the maximum variation in strength was 0·4 per cent. and the average variation only 0·2 per cent.

Power-equipped Sprayers.—This year there has been produced for sulphuric acid distribution a power-equipped sprayer in which manual labour and handling of the acid are reduced to a minimum. This unit, shown in Fig. 6, is manufactured by Messrs. D. T. Gratton & Sons and carries a 2 h.p. Blackstone engine driving a semi-rotary pump that fills the 100 gal. barrel with water in five minutes. At the same time strong acid is pumped by hand direct from the carboys into the sprayer, and the solution is mixed under cover, inside the barrel, by means of a vertical reciprocating paddle driven from the engine. For a farm on which a considerable acreage is sprayed annually, there is much to commend this machine on the score of working rate, low draught, and ease of operation. On a day's run last spring (1935), with two men and one horse (water being adjacent to the headland), a steady output of nearly 2½ acres per hour was maintained, while the cost of spraying, excluding the chemical, was 4*s*. 9*d*. per acre.

The Co-operative Use of Spraying Machinery.—On the majority of farms there is insufficient annual work in the way of weed spraying to justify the purchase of an axle-driven machine, and a trial of the co-operative use of equipment for sulphuric acid has been carried out at Oxford (Ref. 24). Four farms where Charlock is recurrent were grouped together and 94 acres were sprayed during the period May 14 to 29. In a report of the first year's experience it is stated that the results were promising, spraying in no instance being delayed, while transport costs of the machine and pumps were below 5*d*. per acre. The inclusive spraying cost at the various farms varied from 10*s*. to 12*s*. 6*d*. per acre, depending on the strength of the acid used.

Recent Developments in Wet Spraying Machinery.—Among the novel types of sprayer not in general use in this country is the Kartof Disc Sprayer (Fig. 7), in which the spray is produced by allowing the liquid to flow from the barrel by gravity, through a single pipe and a float chamber, on to a metal disc driven by gearing from the land wheels. The disc revolves rapidly, at 1,500/2,000 r.p.m., and produces by centrifugal force a very fine spray, so avoiding the use of jets and the possibility of their choking. The principle of this machine is attractive, and the simple design and the small number of machined parts in the sprayer facilitate the use of hard alloys of high corrosion resistance. In some respects the disc sprayer compares unfavourably with the standard type, as control of the volume delivered per acre is less definite, while in windy

weather the spray drifts sufficiently to render regular work difficult.

In the United States of America an ingenious design of machine for sulphuric acid has been tried, contact between the corrosive spray and the pump being avoided. Water and strong acid are carried in separate tanks, while the pump used is of the high-pressure fruit-spraying type. Water only passes through the pump, while the acid is sucked in by means of a Penberthy steam ejector on the delivery side, and is mixed in the pipe line while passing to the jets. The use of an injector for this purpose requires a much higher pump pressure than would be required in the ordinary way for spraying field crops, and it is

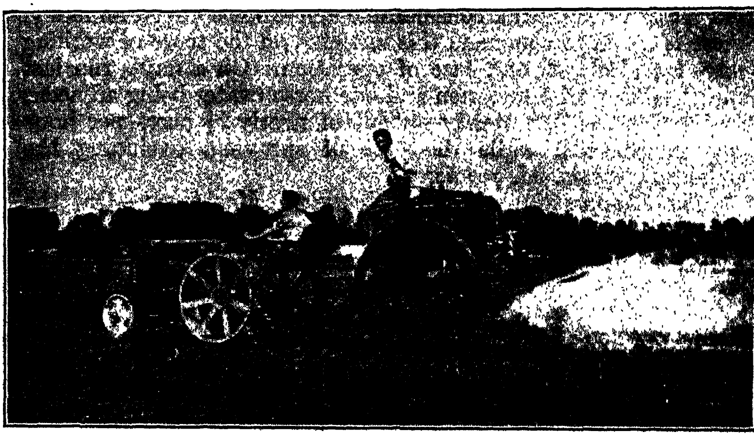

FIG. 7.—The Kartof Disc Sprayer demonstrated at the Trial Station of the Oxford University Institute for Research in Agricultural Engineering.
(*Photo H. C. Long.*)

doubtful whether this type would prove as economic in practice as the standard sprayer.

The French Hardy-Gravelat spraying machine has an iron tank lined with rubber; mixing of water and acid is ingeniously arranged to take place in the tank; the liquid is air-ejected through the nozzles in a fine spray; the lance is 16 ft. 3 in. long; there are forty ebonite nozzles 5 in. apart; no working parts are in contact with the acid; the capacity is 100 to 110 gal.; and the price is approximately £90.

It is of interest to record that a machine specially designed for sulphuric acid spraying has recently been introduced by Messrs. Fison, Packard & Prentice, Ltd., Norwich. Instead, however, of being filled by suction, the acid and water are introduced in the usual way, by hand or pump, and the air

compressor is only used to eject the solution through the nozzles. It has a tank capacity of 120 gal.; a spraying capacity from 50 to 100 gal. per acre; a spraying arm of 16 ft. 6 in.; and Dunlop farm wheels, adjustable for width. It should have the effect of materially reducing depreciation, usually a considerable item in the total cost of spraying.

"*Dry Spraying*" *Equipment.*—In this country powders for weed destruction, such as calcium cyanamide, are generally put on with an artificial manure distributor. In comparison with wet spraying, the cost of application is lower, roughly 1*s.* 6*d.* an acre by distributor as against about 4*s.* 6*d.* with an axle-driven liquid sprayer.

In recent years, owing to the development of concentrated fertilizers, distributors have made considerable progress in the direction of uniform application at low rates of discharge, but most machines fall short of the exacting requirements demanded when destroying Charlock with a light powder dressing.

It has been shown in a series of tests by Keeble (Ref. 25), at Jealotts Hill Agricultural Research Station, that great variation exists in uniformity of application between different makes of fertilizer distributor. Twelve different machines were tested and varied from 8 to 44 per cent. efficiency as measured by the uniformity of distribution along the track of the machine. Across the track, however, uniformity was higher, varying from 24 to 84 per cent. efficiency.

A report on manure distributor trials at Wye College, by Davies (Ref. 26), includes a series of comparative photographs of cyanamide distribution at 1 cwt. per acre by several well-known machines. They indicate a tendency to deliver a ridge-like or streaky dressing of the light powder, and it is suggested that spreading might be improved by hitching a light brush harrow behind the machine.

When it is remembered that the ideal is to coat every weed leaf evenly with a light dust, a degree of uniformity that may be considered satisfactory when applying artificial manure is seen to fall short of that required when applying materials for weed destruction, and the practical difficulty of attaining this ideal with any standard distributor will be realized.

In many cases where it is considered satisfactory to effect a *partial weed destruction*, or the prevention of seeding, dry top dressings are put on as much for their manurial value as for weed eradication, so that a very high degree of uniformity of application, comparable to wet spraying, is not the major aim.

Improving the Uniformity of Application of Distributors.—Various methods designed to increase uniformity have received attention. Among the simplest, where sufficient clearance exists, is to suspend a roll of wire netting below the discharge

of the machine in order to break up the falling streams of powder.

In Denmark a rotating paddle has been used in some distributors in order to obtain more uniform applications. As shown in Fig. 8, this comprises a horizontal shaft suspended below the outlet and running the full length of the hopper. The shaft carries twenty paddles, is driven through gearing from the land wheels and rotates at 100 r.p.m. with a machine speed of 2 m.p.h. The paddle device can be fitted to an existing machine, where the drive permits, at a cost that has been stated as equivalent to some £4 sterling. This device is said considerably to improve the uniformity of distribution of light powders such as cyanamide and, since all moving parts are outside the hopper, it adds but little mechanical complication.

FIG. 8.—Distributor with rotary paddle to increase uniformity of application.

(*Photo kindly lent by Messrs. Shaw, Scott & Co.*)

Powder Blowers for Weed Destruction.—In this country powder blowers are used almost exclusively for horticultural purposes or for the dry spraying of potatoes, and are capable of applying light dressings as low as 10 to 15 lb. per acre.

For the application of 1 to 2 cwt. per acre of powder such as cyanamide, to weed-infested corn, there is at present no blower of British manufacture, but on the Continent, where dry methods of weed destruction are more general, powder blowers of simple construction are frequently used.

An example of a Danish powder blower for applying ½ to 2 cwt. of dry material per acre is shown in Fig. 9. In this machine,

costing £32, the powder is carried in a wooden hopper holding 10 cu. ft. and is fed to the delivery duct of a paddle-fan driven by gearing from the land wheels. With a machine speed of 2 m.p.h. the fan runs at 300 r.p.m., delivering the mixture of air and powder to a spreading box 3·5 yards in width, while during distribution the width covered is generally from 14 to 16 ft., because of drifting of the powder cloud. Neglecting the short filling time, the working rate at this forward speed is from 2½ to 3 acres per hour.

On test, this machine, when tractor drawn at 3 m.p.h., has given very uniform delivery of calcium cyanamide across the

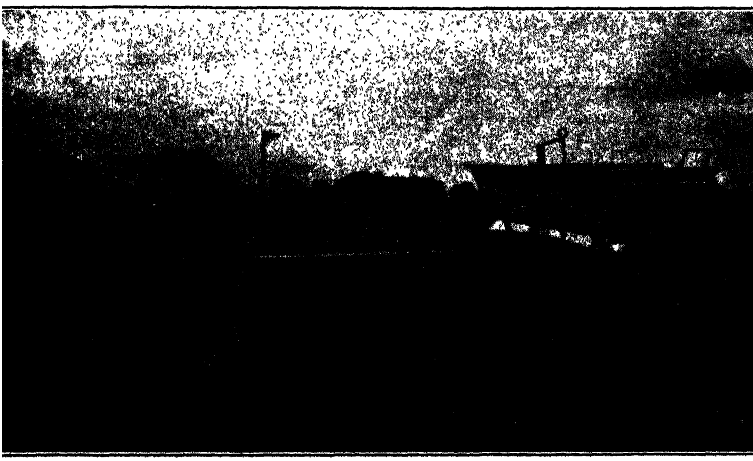

FIG. 9.—Danish Powder Blower applying 1½ cwt. Cyanamide an acre. (*Photo R. K. MacDowall*).

track at a dressing of 150 lb. per acre, and it would appear that where dry fertilizers are used primarily for weed control the advantages of mixing with air are considerable.

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HALF A CENTURY OF CHANGES ON AN EAST ANGLIAN FARM.

DURING the last sixty years British Agriculture has experienced marked fluctuations in the level of both prices and costs, and there is little doubt that farming systems have undergone considerable modifications to meet these vicissitudes. The present study is based on detailed financial records relating to a farm in Suffolk, that has been in the occupation of one man and his son since 1877. These records make it possible to review the effect of the changing economic circumstances on the annual balance sheet, as well as on the organization, of this particular farm. Studies of a similar type are uncommon, and the writer has been unable to find any other published account covering, in unbroken sequence, such a long period of years. Miss Grant's monograph—*Everyday Life on an Old Highland Farm*, 1769-82 (Longman's)—gives a delightful account of the mode of life of the "Tacksman" of Balnespick and his sub-tenants, and also provides an insight into the agricultural conditions of the locality during these years. J. Llefelys Davies, writing in the *Welsh Journal of Agriculture*, 1934, deals with certain aspects of the farming practised on a Cardiganshire holding during the last twenty-five years of the nineteenth century. The interest of these two studies lies primarily in the picture they give of the general agricultural conditions of their respective periods and localities, for the financial information contained in the original records was far from complete.

Before going on to a description of this particular Suffolk farm it would not, perhaps, be out of place to give a very brief summary of the agricultural history of the period embraced by this review. The year 1874 is generally recognized as the beginning of the agricultural depression which characterized the last quarter of the nineteenth century, though since 1862 the prosperity of the "Golden Age" had been waning. These unprosperous times were brought about, chiefly, by economic circumstances—the fall, first in corn prices, and second in meat prices; but climatic causes also played a considerable part. It was not until 1903 that a slight, but nevertheless continuous improvement became apparent. This amelioration continued up to 1914, when its slow progress was accelerated by war-time conditions. With the fall in prices after 1920 another period of acute depression began, which, after 1924, was accentuated for the employer (though relieved for the labourer) by the actions of the Wages Boards. More recently a slight improvement has been noticeable, due, in large measure, to Government assistance rather than to natural economic recovery. Broadly,

therefore, since 1877, British farming has experienced two periods of low prices, and has had one short but thoroughly disorganized time of high prices. It may be of interest to trace the fortunes of a particular farm through this stormy period.

The farm under review is situated to the south-east of the county of Suffolk, where the boulder clays of the centre give way to the glacial gravels which fringe the coast. On the farm itself both the appearance and the texture of the soil would lead one to suppose that boulder clay is predominant to gravel, and it might be reasonable to state that the soil is something between a heavy clay and a strong loam. The topography of the farm, like its soil, resembles that of the centre of the county more than that of the seaward side.

Although the soil is not of the heaviest clay, the flatness of the fields makes it difficult for the rain-water to run off the land. In the 'eighties some of the fields were pipe drained, but the drains, in common with many others laid at that time, were put in too deep to be really effective. More recently, use has been made of the mole plough on certain of the fields. However, the greater part of the farm is not now effectively underdrained, since the cost of laying pipes is prohibitive, while the absence of any appreciable fall on many fields, makes mole draining impossible. The surface water is, however, carried off by a system of water furrows. Essentially, water-furrowing consists in leading the water from the furrows between the stetches—all corn is drilled here on the nine foot stetch—to the ditches along the headlands. The "water furrow" is drawn out with a plough, but the finishing touches are put to it with a spade so as to ensure a steady fall towards the ditch. Through long acquaintance with each field, the bailiff can tell very accurately where to draw each water furrow, so that the maximum amount of surface drainage is obtained.

No description of the neighbourhood would be complete without reference to the market facilities. A large county town with a live-stock and corn market lies only a few miles away from the farm. In the earlier years of this review the barge traffic between this town and London afforded a cheap means of transporting hay to the Metropolis. More recently, the growing population of the local town itself has opened up new marketing facilities.

The study of the farm commences at Michaelmas, 1877, when the grandfather of the present occupier purchased it for about £70 per acre. It then extended to 208 acres, of which 183 acres were arable, 11 acres grass and 14 acres buildings, roads and waste. As far as can be ascertained from the account books, the muck, hay and growing seeds were taken over at valuation from the outgoing occupier, but most of the live and

dead stock was purchased elsewhere. At the time the holding was considered quite a fair-sized one in the boulder clay district of Suffolk (which was well known for the smallness of its farms), but there is evidence, in the form of an isolated barn and some yards, as well as a few mounds that, at some earlier date, the farm had been made by combining two separate holdings.

In 1877, the main buildings were at one end of the farm, but subsequent additions to the holding have brought them more into the centre. Up till 1913 the area of the farm remained unaltered, but in that year three fields, covering some 50 acres of land in a somewhat impoverished condition, were added. Towards the end of the War the acreage was further increased by taking over a neighbouring farm of 150 acres. This land, which had been farmed on "prairie" methods, was purchased for less than £10 per acre, a figure which reflects the very poor condition in which the previous occupier had left it. These additions have brought the present area of the farm to 430 acres, on which there are two sets of buildings.

Cropping.

Although during the last, and the earlier part of the present century, it was the general custom in the county to adhere closely to the Four Course Rotation, in latter years economic circumstances have generally resulted in considerable modifications. On this farm, however, deviation from this rotation has been rare, even in recent years. It is not claimed that the custom was as slavishly followed as on the farm of Mr. Street's youth, perhaps as a result of the fact that "they blasted sheep" were stores, and not the breeding flock which ruled the cropping of Partridge Farm. However, few farmers can truthfully say that once only in the last fifty-seven years have they taken two white straw crops in succession; then tradition gave way to patriotism, but the experiment was never repeated. Such was the effect of this step on the land that a bare fallow became imperative in the next year.

It is unnecessary to give a detailed description of the four-course rotation practised on the heavy land of Suffolk. This seems to have altered little since Raynbird described it in the *R.A.S.E. Journal* for 1847; mention will be made only of the more noticeable innovations and modifications in the cropping which have been made on this particular farm. Apart from the usual fodder crops grown for sheep and bullocks, potatoes, sugar beet, and mangolds and swedes for seed, have found a place in the fallow shift from time to time. Sugar beet was first grown, in 1883, for a factory at Lavenham which, however, owing to financial difficulties, closed down within a few weeks

of the beginning of the manufacturing season. For two years before the War, beet was grown for the Cantley factory, and, although the crop has been taken intermittently since 1924, the area under beet has never exceeded 14 acres. The seed root crops, which were grown for a local seed firm during and for a few years after the War, gave a very good return per acre, amounting to £75 in 1919, and over £30 in the two succeeding years.

The fallow course has usually been followed by spring corn, and, in general, the barley acreage has exceeded that of oats. It might be pointed out that the barley grown on this land is, in most years, too coarse for malting. Before the more general introduction of oats, it was the practice to take Rivett's Wheat after the bastard fallow that followed the summer crops folded by sheep, and, especially during times of high wheat prices, red wheat has sometimes taken the place of spring corn after bare fallow.

There is little to say regarding the rest of the rotation. Apparently broad red clover has always been preferred to a mixture or Dutch white, and in the 'eighties a great deal of this red clover hay—or "stover" as it is called locally—was sold off the farm. The fate of the second crop depended both on the weather and on the amount of second-crop required for fodder. In a good seed year, up to 15 acres of the second cut have been harvested for seed.

There were only 11 acres of grass on the farm when it was taken over, but in 1885 a further 17 acres were sown down. From that year until 1913, permanent pasture accounted for 15 per cent. of the farmed area, but when more arable land was taken on the proportion fell to 12 per cent. In 1918, 50 acres of rather indifferent grass was added to the farm. Since 1922, more and more land has been put down to permanent pasture, firstly to supply grazing for the dairy herd and secondly to reduce costs—especially the labour bill. The following gives some indication of the growing proportion of grass in recent years: in 1919, 21 per cent. of the farmed land was grass; in 1924, the proportion had risen to 31 per cent., and by 1933 the corresponding figure was 58 per cent. There are now 220 acres of permanent pasture on the farm.

Although a few ewes were bought in 1930, to enable mixed grazing, they became infested with worms and had to be sold. Thus, at present, there are only forty-five cows and their followers grazing on this grass, though some hay is taken each year. The pastures are obviously understocked, but reference to the financial data in a subsequent section will show that the grassland policy—as a temporary measure, at any rate—has met with some success.

LIVE STOCK.

The live stock policy really falls into two periods. The first of these covers the years 1877–1910, during which time bullock and sheep fattening were the chief occupations followed. In the second period, considerable modifications and changes were made, and, after 1910, pig fattening and then dairying became the most important live stock enterprises. It can be understood, then, that although the cropping system has altered little during the fifty-seven years of this study, large innovations have been made in the live stock policy.

During the first period, on an average, twenty-five fat cattle were sold annually, while a few beasts were also marketed as stores. In the earlier years it was the practice to buy in Irish cattle of about 10½ cwt. for fattening, but after 1890 smaller beasts (or "buds") of about 5 cwt. were purchased. These "buds" were kept on the farm for twelve months before being brought into the yards. In the 'eighties and during the first twelve years of the present century, Lincoln, and later Suffolk hoggets were fattened. Although in the earlier years sheep were kept on the farm in the winter months, it was more usual to buy store hoggets in spring and sell them out fat in August. In the 'nineties instead of fattening sheep, the summer green crops were hired out to a neighbouring farmer, who paid from £90 to £100 annually for this summer "keep." The other live stock departments were subsidiary to the bullocks and sheep until 1907, when the pig enterprise grew in importance. From time to time a few cows were kept and the bulk of their milk was made into butter. Less than 100 head of poultry picked up a living around the yards, and were considered an unimportant side-line.

Although detailed cost accounts were not kept, the occupier used to supplement his annual accounts by making an estimate of the amount left by each live stock department to pay for bulky foods, labour and overheads. The estimates show that the amount available to cover these charges in the bullock and sheep fattening departments was often small, and in some years actual deficits were recorded. On the other hand, those accounts dealing with the pig-fattening department indicate that, despite the fact that these animals consume no bulky foods, the return was considerably larger. It is not surprising then, to find that bullock and sheep fattening were given up (in 1910 and 1912 respectively) and that the pig enterprise was further developed.

In the five years prior to 1910, an average of seventy-six fat hogs was sold and six breeding sows were kept, whereas, since that year, an average of over 150 fat hogs has been sold annually, and there has been a corresponding increase in the

breeding stock. It should be pointed out that the above do not show the total sales of pig meat because, from time to time, store pigs and breeding stock have also been disposed of. Up till about 1924, the hogs, which were either a cross of Large White ×Berkshire origin or Gloucester Old Spots, were marketed as pork, but more recently the pigs have been fed for bacon. In common with many other farmers, the occupier now finds that the progeny from a Large Black sow mated with a Large White boar is most suited to modern trade requirements.

A few Jersey cows were kept in the earlier years of the present century, but it was not until 1912 that the occupier joined the English Jersey Cattle Society. In the same year he purchased a foundation cow, and from this cow and others bought in the next few years, the present pedigree herd of some forty cows has been built up. The greater part of the milk was, until 1922, made into butter, and in the years 1914–21 over 3,000 lb. of butter were sold each year. By 1922, the price of butter had fallen to such an extent that it became apparent that it would be more profitable to sell the milk whole, and by this date also there was undoubted scope for the development of a milk round in a local town. The milk was well advertised : soon the horse-drawn float was unable to cope with the increased sales, and within a few months a motor van had to be purchased. No figures are available showing the sales of milk in each year, but in 1933–4, 18,950 gallons of milk and 1,060 lb. of butter were sold.

The other live stock can be dealt with briefly. A few flying flocks of Suffolk lambs have been purchased since 1922. Reference has already been made to the ewes that were purchased for a basis of a grassland flock. Although the poultry are not so important on this farm as on many, they are now something more than a relatively unimportant side-line.

Financial Data.

Profit and Loss.

In discussing the profits and losses recorded during the period, it is important that the sense in which these words are employed should be clearly understood. The figures in the following section are taken from the annual profit-and-loss accounts, which are constructed from the detailed records of income and expenditure and from the valuations made at the beginning and end of each year. The expenditure items do not include any charge for interest on capital, nor for the work of the occupier himself. As the farm is owned by the occupier, a "fair" rent has been substituted for the expenses which would normally have been met by the owner, in order to bring

the accounts on to a basis comparable with those of tenan farmers. All drawings in kind have been credited to the farm at market price. Thus "net profit" here represents the amount available to reward the capital invested in the farm live and dead stock, and to remunerate the occupier for his work and risk.

During the fifty-seven years, thirty-three profits and twenty-four losses have been recorded. In general, profits have exceeded losses, and through the whole period the net return has been equivalent to an average profit of £200 (£74 per 100 acres) per annum, or 5·5 per cent. on the average annual capital. As the profit, according to the definition given above, is required both to remunerate the occupier and to cover interest on his capital, it is clear that the average return has been inadequate. If the capital had been invested at 4 per cent., it would have brought in £150 per annum, which leaves only £50 out of the £200 as a return for management—not to mention the risk and worry attached to farming. But the average figure fails to give an indication of the distribution of the profits and losses, and Table I shows the variations in the returns for certain well-defined groups of years. The amount of capital invested in the farm has, of course, varied from time to time, while the acreage has increased in recent years. To allow for this latter the profit or loss is also shown per 100 acres.

TABLE I.

AVERAGE ANNUAL PROFIT OR LOSS FOR CERTAIN PERIODS.

Period.	Number of years in period.	Frequency of annual profits and losses.		Average Net Profit (+) or Loss (−) per annum to remunerate capital invested in farm live and dead stock, and the work of the occupier.		Average Net Profit (+) or Loss (−) as per cent. of capital invested in farm live and dead stock.
	Years.	Profits.	Losses.	Total. £	Per 100 acres. £	%
1877-89 .	13	4	9	− 62	− 30	− 2·3
1890-99 .	10	7	3	+ 69	+ 33	+ 3·6
1900-13 .	14	11	3	+ 160	+ 68	+ 6·3
1914-19 .	6	6	—	+1772	+611	+24·4
1920-31 .	12	3	9	− 217	− 50	− 3·4
1932-33 .	2	2	—	+ 638	+148	+13·0
1877-1933 .	57	33	24	+ 200	+ 74·5	+ 5·5

On only four occasions during the first thirteen years was any profit made, and the average annual loss was £62, or £30

per 100 acres. These losses are understandable in the light of the bad conditions at the time, of which Lord Ernle says "the collapse of British trade checked the growth of consuming power at home, and at the same time a series of inclement seasons, followed by an overwhelming increase of foreign competition, paralysed the efforts of farmers." As well as the more general causes for the financially unprosperous condition of the farm in these years, mention must be made of the particularly poor harvest of 1879, and the fact that the farm had only just been taken over. Conditions were bad in 1883, when the Duke of Richmond reports on Suffolk—"from all sources I learnt that Agricultural depression existed, and had existed for some years past."

Prices of all commodities were very low in the 'nineties, and the inclement harvests of the early years of the decade also contributed to the bad state of farming. During these ten years a small profit was made, and two of the three losses (*vide* table) were recorded in 1893-4 and 1894-5, years which marked the nadir of pre-War wheat prices. As possible explanations of the relative improvement on the farm during the 'nineties, three suggestions may be made :—

(1) Sheep keep was hired out, and so no money was lost on fattening sheep, which, even in those days, must have been an expensive means of manuring the land.
(2) A fall in rent from 35*s.* per acre, in the early 'eighties to 21*s.* in the late 'nineties.
(3) Greater use of home-grown foods.

Despite the series of small profits referred to above, the years 1877–1903 were far from prosperous. Reference to the Reports of the various Agricultural Commissions which sat during this time would show, however, that this farm did better than many, for all the land was kept under the plough and the crop yields showed no serious deterioration, facts indicating that the general standard of husbandry had not declined. Furthermore, a small annual profit was obtained.

After 1903, prices generally showed an improvement, and except for a small deficit in 1907, no further losses were recorded until 1920. The annual profits increased up till 1914, when war-time conditions accentuated the previous slow, but sure, rise in the price level. The average profit of £160, or £68 per 100 acres, made during these fourteen years, indicates a much more healthy state of affairs than that found in the last twenty years of the 19th century. During the earlier years of the century there were no radical changes in farm policy, for it was not until 1910 that bullock feeding was given up. The general improvement in prices, rather than policy changes,

must, then, have been largely responsible for the more favourable state of the farm balance sheet.

The returns for the War years include an abnormally large profit for the year 1917–18, which was caused by a sudden upward revision of valuation scales in that year. This profit amounted to £4,790 (of which £4,040 was due to the valuation increases), and was the largest recorded during the fifty-seven years. In order to obviate large book profits during the War, and corresponding book losses afterwards, it had been the occupier's original intention to value everything in the annual stock-taking at approximately pre-War prices; but owing to certain practical difficulties, he changed his mind, for the words "everything raised to market price" are found in the valuation summary of Michaelmas 1918. The result of this has already been mentioned.

The inevitable post-War fall in prices resulted in re-adjustments having to be made in the annual valuation figures, and this, coupled with the reduced receipts and the lag in costs, led to heavy losses being recorded. In 1921 a large loss of £924 was made, despite the Government subsidy of £4 per acre for oats and £3 per acre for wheat when the Corn Production Act was repealed. This payment amounted to £266. In nine of the twelve years 1920–31 the farm lost money, and it will be seen that quite a large average deficit is shown for this period. The three years in which profits were recorded were 1925–6, 1928–29, and 1931–32. The fact that 100 acres of foul arable land were taken on in 1918 must have accentuated the post-War losses, for this land took some years before it could be got into good order.

In the last two years covered by this study, and particularly in 1933–4, the financial position of the farm has improved. The following facts, among others, are probably responsible for this: (1) the reduction of arable land; (2) the relative cheapness of feeding stuffs; (3) the increase in the volume of milk and in the number of pigs sold; and (4) the wheat "deficiency payments" obtained under the Wheat Act (1932). Of these it is only possible to show, at all accurately, the effect of the last, which amounted to £260 in 1932–3 and £300 in 1933–4.

To sum up, throughout these fifty-seven years the two leanest periods were 1877–89 and 1920–31, during which time eighteen of the total of twenty-four annual losses were recorded; a fact which emphasizes the uneven distribution of the profits and the losses. If the six years 1914–19 are excluded, the average annual profit is reduced to £16 for the remaining fifty-one years. The mere exclusion of the profits for these years does not, of course, eliminate the total effect of the War on agricultural prices, as the relatively low prices for, at least,

ten years after the War, were, in a large part, the direct outcome of wartime conditions. It is often said that what a farmer makes during the high prices of wartime, he loses in the slump that follows. This does not seem to have been the case on this particular farm, for over the eighteen years 1914–31, an average annual profit of £446 has been obtained. It has been shown that the distribution of the profits and losses—both numerically and quantitatively—is uneven, and that the £200 profit is essentially an average figure.

These remarks, as well as the information in Table I, do show the ups and downs of this farm over a period of more than half a century. A study of the agricultural history of the time will show that these fluctuations in fortune coincide in general with those of the farming industry as a whole. It is noteworthy that these changes in the financial position of the farm are shown despite the alterations in farming policy. What the average annual loss would have been if the traditional beef-and-wheat organization had been continued, one cannot attempt to say. But the question arises, could the farmer have endured fifty-seven years of these methods, without bankruptcy or suicide, or both?

Capitalization.

Earlier in this chapter, the net returns of the farm were expressed as a percentage of the capital invested (Table I). In Table II the total amount of capital, and also the capitalization per 100 acres of farm land, are shown. These figures are taken from the annual valuation summaries.

TABLE II.

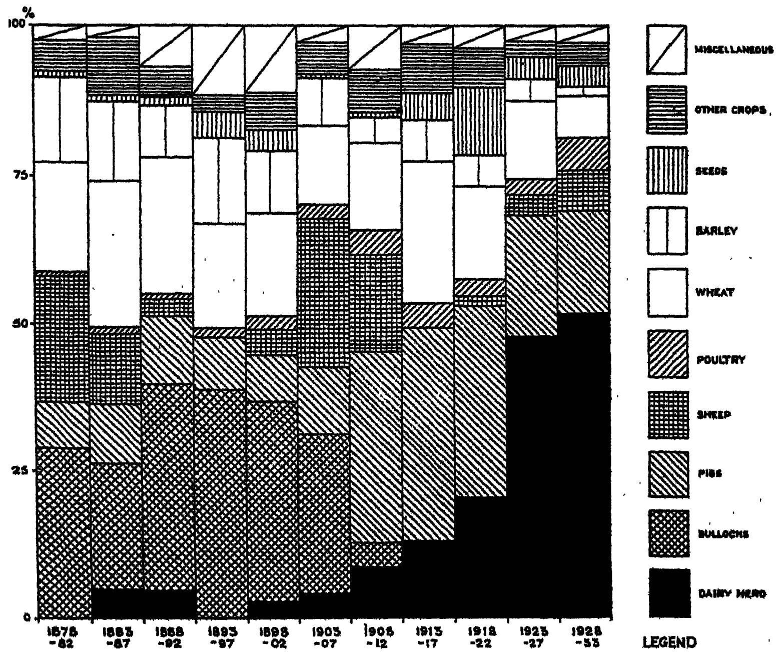
TOTAL CAPITAL INVESTED IN FARM LIVE AND DEAD STOCK.

Period.	Total Capital for Farm.	Total Capital per 100 acres.
	£	£
1877-89	2,624	1,260
1890-99	1,906	916
1900-13	2,552	1,180
1914-19	7,245	2,340
1920-31	6,250	1,450
1932-33	5,020	1,160

Changes both in the value of money, and in the general farm policy, of course, influence these figures. For example, the low commodity prices of the ten years 1890–99, as well as a decrease in the head of live stock carried, are responsible for the fall in the value of the capital invested during these years. The high figure for 1914–19 reflects wartime prices, whereas the smaller capitalization in the last fourteen years is due both to the fall in values and to the increasing proportion of grassland.

GROSS RECEIPTS.

Figures referring to gross receipts reflect the importance of the various items from the point of view of their direct contributions to the bank balance. Such figures do not, of course, necessarily give any indication of the cropping or of the capitalization or labour requirements of the different enterprises. For example, crops grown wholly for fodder do not appear in a statement of gross receipts, because their value is included in the sales of live stock and live stock products. But the fact remains that details of the composition of the gross income give an indication of the relative *cash* importance of the various departments of the farm. The percentage distribution of the chief sources of income are shown in Fig. 1.



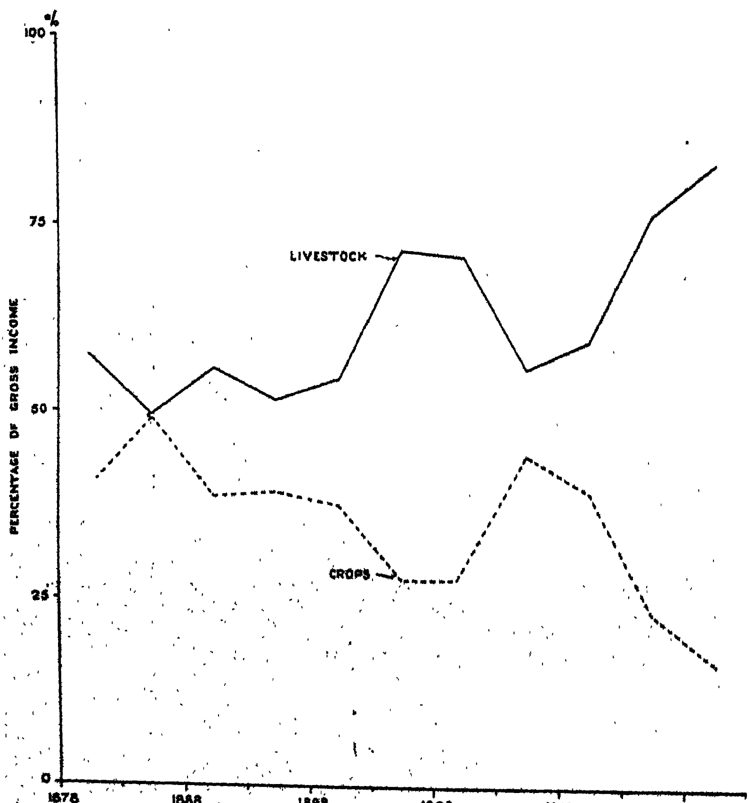
PERCENTAGE DISTRIBUTION OF GROSS RECEIPTS IN FIVE-YEARLY PERIODS

FIG. 1.

Percentage Composition of Gross Receipts.

Fig. 2 shows the fluctuations which have taken place in the relative importance of crops and stock as direct sources of income. The most noticeable features are the downward movements of the crops curve in the ten years 1903-12 and again after 1922. The irregularities will be more easily understood when the

live stock sales curve has been discussed, but it must be remembered, at the outset, that the policy of putting land down to grass, adopted in recent years, has reduced the area available for growing cash crops. Cereals, which in the first twenty-five years represented 34 per cent. of the total receipts, now contribute a mere 9 per cent., and hand in hand with this goes the decreasing importance of wheat sales. The wheat crop (*vide* Fig. 1) has—except in 1919, when sales of leguminous and root seeds represented 19 per cent. of the gross income—always accounted for a higher percentage of the total receipts than any other crop. In general, barley has been second in importance, though in more recent years seeds has taken its place. The practice of consuming the bulk of the barley crop on the farm accounts



PERCENTAGE OF GROSS RECEIPTS REPRESENTED BY CROPS & LIVESTOCK

FIG. 2.

largely for this. Sales of beans, peas and, in some periods, of oats represent only small parts of the income. This is, of course, due to the fact that in most years (though there are exceptions) the greater part of these crops was consumed on the farm by the live stock.

Hay sales, which were of importance in the years 1882–95, and once during the Great War, have represented, at one time or another, up to 6 per cent. of the total income. Seed crops, which were not taken every year, did not contribute very largely to the total receipts prior to the introduction of seed swedes and mangolds. It was the latter crops that maintained the total crop sales at 39 per cent. in 1918–22, when sales of wheat and other crops were waning in importance. Sugar beet has always been a comparatively unimportant crop and, even in recent years, has never produced more than 2 per cent. of the total receipts.

Fig. 1 shows that the receipts derived from live-stock sales, fall roughly into four periods. The first, from 1878 until 1902, was the time when fat bullocks were the most important item of income. Though in some years sheep were fattened, and did bring in as much as 25 per cent. of the gross receipts, this was not the general practice throughout the first twenty-five years of this review, for it will be remembered that in some years summer sheep-keep was let. In these early years dairy cows and pigs did not contribute very largely to the income, and live stock as a whole represented just over half the total sales off the farm.

The ten years following 1903 make the second period. This was a transitional period when bullocks and sheep were giving way to pigs in the farm economy. The large increase in the total live-stock sales (Fig. 2) is due to the re-introduction of feeding sheep, and the fact that the pig enterprise increased before the bullocks finally disappeared. This corresponds with the decrease in crop sales to which reference has already been made.

During the next ten years (1913–22), sales of fat pigs and sows represented more than one-third of the total receipts, though the income from both the dairy produce and stock was of more importance than previously. Most of the milk was, at this time, cashed in the form of butter but, as the separated milk was fed to pigs, it can be seen that the receipts for dairy produce under-estimate the real value of the milk. The effect of changing over to the sale of whole milk is seen in the next period (1923–33). It was with the starting of the milk round in 1922 that this fourth period commenced. The increased sales of dairy produce, which now represent more than half the total receipts of the farm, are due entirely to this change of farm

policy. Coincident with the greater sales of dairy produce there is a marked rise in the live-stock curve (Fig. 2), which now shows that live stock represent as much as 83 per cent. of the gross income. Eggs and poultry, although never an important item of income, have contributed much more largely to the total receipts in recent years. Despite the importance of live stock and live-stock products in the last ten years or so, receipts from this source have, throughout the whole period, amounted to just over 60 per cent. of the total income.

Absolute Value of Gross Receipts.

The annual receipts for the whole period average £11 per acre, but Table III shows that there have been considerable variations in the figures from time to time.

TABLE III.

Gross Receipts per 100 Acres.

Period.	£	Period.	£
1878-82	1,074	1908-12	866
1883-87	956	1913-17	1,368
1888-92	820	1918-22	1,733
1893-97	707	1923-27	1,222
1898-02	800	1928-32	1,210
1903-07	1,057		

The decreased value of receipts between 1883 and 1902 is due partly to low prices and partly to the change in policy, to which reference has already been made. With the re-introduction of feeding sheep after 1901, and the improvement in prices, the total receipts increased, while the marked rise during the War period naturally reflects the price conditions of that time. Although the post-War receipts have fallen, they have not reached their pre-War level, owing to the changes in the farm policy in the last twenty-five years.

So much for a general survey of figures, showing changes in both the relative composition and the volume of the gross income. One further illustration may, however, be given of the extent of the changes which have taken place. This particular example has been chosen because it shows how great has been the departure from the older methods practised on this farm Bullocks and wheat can be taken as the important sale items of early years and as the traditional cash products of East Anglian farming. In Table IV their combined contribution to the total receipts is compared with that of dairy produce.

Table IV shows that while beef and wheat sales together represented about half the gross receipts in the early years, dairy produce and stock have taken their place, and that the percentage for beef and wheat in later years is comparable

with that for dairy produce in the earlier ones. It will be remembered that pigs have also been developed on a much larger scale in the past twenty years.

TABLE IV.

CASH RECEIPTS FROM BEEF AND WHEAT COMPARED WITH THOSE FROM DAIRY PRODUCE AND STOCK.

Period.	Percentage of gross receipts represented by	
	Beef and Wheat.	Dairy Produce and Stock.
	%	%
1878-82 . .	49·0	—
1883-87 . .	46·0	4·8
1888-92 . .	53·0	4·7
1893-97 . .	55·6	—
1898-02 . .	50·5	2·7
1903-07 . .	40·9	4·0
1908-12 . .	19·2	8·5
1913-17 . .	24·0	12·0
1918-22 . .	16·0	20·0
1923-27 . .	12·7	47·9
1928-32 . .	5·7 (6·9) [1]	53·7 (53·0) [1]

[1] Including Wheat Deficiency payments.

COSTS.

Over the whole fifty-seven years, costs have averaged £10 10*s.* per acre, though, as Table V shows, they, like the total receipts, have varied from period to period with changes both in farm policy and in general price levels.

TABLE V.

TOTAL COSTS PER 100 ACRES.

Period.	£	Period.	£
1877-81 .	1,208	1907-11 .	867
1882-86 .	1,000	1912-16 .	993
1887-91 .	757	1917-21 .	1,560
1892-96 .	678	1922-26 .	1,301
1897-1901 .	754	1927-33 .	1,220
1902-06 .	1,200		

Fig. 3 shows the changes in the relative importance of the various items of costs throughout the period. In subsequent paragraphs the Labour Bill and Rent and Rates, etc., will be treated in some detail. Lack of space precludes anything but brief mention being made of the other costs, but reference to the sections on the general farm policy will give an indication of the factors causative of many of the changes illustrated by the diagram.

It will be recalled that, up till 1910, large numbers of store bullocks and sheep were bought, whereas purchases of live stock

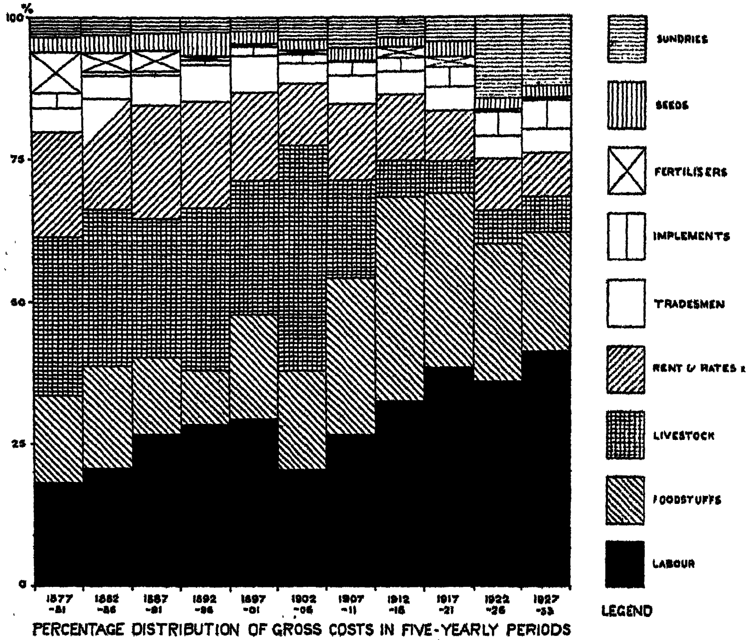


FIG. 3.

have, since that year, been confined almost entirely to breeding stock for the pig and dairy herds. Fig. 3 shows the importance of live stock purchases in the earlier years of this study, and also that the alterations in farm policy have tended, very largely, to reduce both the dependence of the farm on stock bred elsewhere and the incidence of live stock purchases in the total costs.

The two chief factors influencing the amount spent on feeding stuffs on the farm have been the number and type of stock kept, and the relative price levels of farm crops and purchased feeding stuffs. It can be appreciated that the pigs and the dairy herd require a greater quantity of concentrated food than the bullocks and sheep of the earlier years, and it is noticeable that, after the period 1907–11, feeding stuffs have tended to constitute a greater proportion of the total costs. Besides affecting the actual cost of the bought feeding stuffs, changes in price levels have influenced the proportions of the home-grown cereals and pulses retained on the farm for stock food. Ordinarily, the bulk of the oat, pea and bean crops was consumed at home by stock, and in times of low prices larger parts of both the barley and wheat crops were so utilized. The decrease in the importance of the feeding stuffs bill, apparent

during the late 'eighties and 'nineties, and in the last two periods (1922–26 and 1927–33) shown on the diagram, is due to a larger dependence on home-grown concentrated foodstuffs. It may be pointed out that in the last year of this study, when greater advantage was taken of the low price of feeding stuffs, only 10 per cent. of the concentrated food was grown on the farm.

Both "Implements" and "Sundries" have, since the War, assumed more importance in the total costs. The increase in the former may be explained by the greater use which is now made of machinery (though as yet a tractor has not been bought) and also by purchases of vans for the milk round, whereas that of the latter is due to new costs of a miscellaneous nature (petrol, oil, milk bottles, coal, etc.), made necessary by the development of the milk round. It can be seen that the incidence of expenditure on the two items "Tradesmen" and "Seeds" has remained fairly constant.

It is noticeable that in recent years manures represented a smaller part of the total costs than formerly. In the first twenty years of this study, the expenditure on this item was equivalent to £46 per 100 acres of arable land, whereas, since 1897, the corresponding figure has been £10. In the earlier years it was the practice to cart on to the farm stable muck, refuse and nightsoil from a neighbouring town, and it is no uncommon thing to find entries in the account books of these years of the purchase of ten or more waggon loads of muck or refuse. Actually, in 1880, seventy loads of refuse were bought and in the following year, fifty loads of muck were carted on to the farm. Other organic manures, shoddy, cake waste, etc., were also purchased and, from time to time, small consignments of nitrogenous fertilizers and a proprietary mixture for roots were used. The books show that purchases of manures during the present century have been small and that, since 1914, phosphatic fertilizers (first as basic slag, then as superphosphate) have accounted for more than half the total of the manure bill. It would appear that, in the last thirty years, the supply of organic plant foods has been reduced, for not only was the practice of carting town muck on to the farm given up in 1900, but the absence of fattening bullocks, since 1910, must have led to a reduction in the amount of manure made on the farm. Under the new live-stock policy, however, it was thought that dung from the pigs and the cows would be sufficient to maintain soil fertility and, in consequence, only small quantities of nitrogenous fertilizers were bought to make up for the loss of the bullock and town muck. It may, therefore, be of interest to examine the crop yields to see how these have reacted to the change in manuring.

Table VI shows the yield for each of the cereal and pulse crops expressed as an index (with the mean yield for the whole fifty-seven years = 100). In the last column a composite index for all the crops is given. This latter is obtained by weighting the individual indices by the acreage devoted to each crop.

TABLE VI.

INDEX OF YIELDS OF CERTAIN CROPS (MEAN YIELD = 100).

Period.	Wheat.	Barley.	Oats.	Beans.	Peas.	Composite Index.
	Index.	Index.	Index.	Index.	Index.	Index.
1877-81 .	85	84	—	91	136	86
1882-86 .	121	106	92	92	—	109
1887-91 .	109	122	114	105	—	114
1892-96 .	109	115	103	103	115	109
1897-1901 .	113	106	120	110	93	110
1902-06 .	100	107	121	108	111	107
1907-12 .	99	100	97	88	99	97
1913-16 .	94	102	81	102	119	98
1917-21 .	95	89	91	85	94	91
1922-26 .	84	101	104	91	75	91
1927-33 .	93	90	91	112	98	93

These figures certainly indicate that there has been a decline in the yields of all crops in recent years but, as new and rather impoverished land was taken on in 1913 and 1918, this decline must not be attributed entirely to the change in manuring. It may be of interest, however, to mention that the occupier now intends to increase his purchases of fertilizers.

LABOUR.

Organization.

Since the occupier has always had more than one farm, it has been necessary to employ a bailiff here throughout the whole period. The bailiff, besides superintending the men, used in the early years to do the drilling, and sometimes went to plough; but more recently his duties have been confined to the supervision of the work on the land and seeing to the general welfare of the stock.

In the first thirty-six years of this review nine horses were kept on the farm, and of these eight were in two-horse teams for work on the land and for heavy carting, while the ninth was used for work about the yards. At times one or two young colts, which were being broken in for town work, used to take the place of one old horse, but as they did only about half the work of an older horse, their presence did not upset the organization of the horse labour. The horses were looked

after by two baiters—the head man and the second man—and two assistant baiters, who were often young lads learning to plough and to handle horses. It was no uncommon thing in the last century for boys who had just left school to go to plough for 6*d*. per day. The head baiter was responsible for the condition of all the horses. A fifth team was added in 1913, when more land was purchased, and from that date until 1918, when further additions were made, the farm became "an eleven-horse farm," with three baiters and two assistants. After 1918, fifteen horses were required on the farm. Of these, five teams and an odd horse were stabled at the original farmstead, whereas the other two teams were at the new buildings. Four regular baiters, who had help from day men, looked after and worked these horses. Since the extension of grassland the number of horses has been reduced to eleven, and these are now all kept at the original farmstead. At the same time there has been a corresponding reduction in the number of baiters.

In the earlier years, the bullock tending was done by a man or, more frequently, by a youth who got the ordinary weekly wage with an extra shilling for Sunday work. The pigs were fed by a boy whose Sunday money amounted to 6*d*. With the increase in the number of cows and pigs just before the Great War, a larger personnel was required to do the milking and pig feeding. In 1912, two youths were employed in the cowshed under the supervision of the bailiff, whilst another fed the pigs. During the War years most of the milking and pig feeding were done by girls. The development of the milk round necessitated further reorganization in the dairy staff, for not only were men required to produce the milk, but one, and later two, were needed to sell it. Four boys and a roundsman comprised the personnel of the cow-house and dairy in 1922; more recently the boys have been replaced by two experienced cowmen who understand both rationing and calf rearing. The purchase of a milking machine in 1930 effected certain economies in labour, but some of these were offset by the expenses incurred by changing over to Grade A production, which entailed extra labour for bottling the milk and cleaning the bottles and dairy utensils. It may be seen that many more men are now employed in connection with stock than previously, for, excluding occasional helpers in the dairy, four men are employed regularly either in producing or selling milk, while a fifth feeds the pigs.

Up till 1913 two, and sometimes three "day men" (or ordinary labourers) were employed regularly, though, of course, extra hands were called in for threshing, chaff cutting and harvesting. These men worked both "by the day" and "on

piece work." Boys and youths, who were not employed with either horses or stock, did some of the lighter jobs of the farm. Since the increase in the area of the farm, four or five day men have been employed, though, more recently, some of these have also assisted in the dairy and with the horses. During the War, women largely took the place of day men, and performed many of the tasks ordinarily allotted to this type of labourer, such as hoeing, root pulling and shocking the corn at harvest. Before the War, old men, who had long been associated with the farm in some fairly responsible capacity, such as that of baiter, were sometimes given a small fixed weekly wage, and allowed to do what, and as much as, they thought fit. Thus, though two or three day men may seem to have been a small number in the early years, it will be seen that boys, youths and old men were available for many of the everyday tasks on the farm.

In the earlier years, school children (on Saturdays and during the summer evenings and holidays) and women, had opportunities to earn money by pulling "carlic" (charlock), picking stones and singling roots. The sixpences which the children received must have been important additions to the family incomes when wages were between 11*s.* and 13*s.* per week. It is interesting to point out that in 1877 the farm was badly infested with charlock, and it was by constant hand pulling that the land has now been practically freed of this weed. Since the War, no women or children have been employed.

This outline of the changes in labour organization shows that, considering the fact that the farm is twice as large as it was in 1877, the increases in both day men and baiters are smaller than might have been expected, among the reasons being the increased proportion of grassland and the introduction of the double-furrow plough. It has been the development both of milk production and of the retail round, rather than the larger farm area, that has led to the changes in the staff employed. It is also apparent that a greater proportion of "high pay" workers are now employed than formerly.

It would be as well, in order to avoid confusion, to define the terms used below. The "weekly wage" is the sum paid to each man for a full week's work, or the "minimum wage" of recent years. It can be seen that this sum does not include any extras in the form of harvest money, perquisites, etc., nor does it make any allowance for any time lost through being stood off or through ill health. On this particular farm, however, the men were always given something to do whenever they came to work and were never sent home in bad weather. When these allowances are made, the worker's "average weekly earnings" through the whole year are arrived at.

TABLE VII.

WEEKLY WAGES PAID TO EACH CLASS OF WORKER IN THE YEARS INDICATED.

	Bailiff.	Baiter.	Day man.	Stockman.
1877	20/-	16/-	13/6	9/6[1]
1882	18/-	13/6	12/6	12/6 & 6/-[1]
1887	18/-	13/6	11/-	9/-[1]
1892	18/-	15/6	13/-	10/-[1]
1897	18/-	14/6	13/-	9/-[1]
1902	18/-	15/6	13/-	14/- & 10/-[1]
1907	18/-	15/6	13/-	12/6[1]
1912	20/-	16/6	14/-	13/-[1]
1917	30/- to 40/-	27/6 to 32/6	30/-	25/-[1] & 30/-[1]
1922	40/-	29/-	25/-	30/-[1] & 25/-[1]
1927	40/-	37/6	30/-	40/- & 25/-[1]
1932	40/-	34/-	28/-	40/-, 38/-, 33/-

[1] = Not a full-grown man.

Table VII shows the weekly wages of the various classes of labourer employed on the farm. Orwin has dealt with the main changes in the wages and earnings of agricultural workers during the last 100 years in this *Journal* for 1931, and it is therefore unnecessary to discuss the table at any length. However, certain points of interest may be mentioned. The wages in Suffolk, in common with those of the Eastern Counties, have always been, and still are, lower than those of the North and Midlands. Orwin gives the wage levels of the various counties, and it can be seen that those of Suffolk have sometimes been as much as 30 per cent. below those prevailing elsewhere (cf. wages of Suffolk and Cumberland in 1892–3, which were 12*s*. and 18*s*. respectively): a discrepancy is also apparent between the farm wages of the East and the North of England at the present day. The higher wages in other parts of the country are due, in some measure, to the competing demands for labour from industrial centres, and also to a higher proportion of grassland and greater concentration on live stock. The general movements in wage levels on this farm, are, however, similar to those of the whole country. During the thirty years before the War there was a rise in wages of about 3*s*. per week (*vide* Table VII). It is impossible to tabulate the weekly wages through the war period, but it will be remembered that although they rose slowly before 1917, the Wage Boards set up under the Corn Production Act established the principle of a minimum wage. The peak was reached in 1920. Wages fell in September of the following year, and this fall continued, despite the efforts of the Conciliation Committees, until 1924, when the newly established Wage Boards raised the wage of the ordinary day man by

some 3*s*. In 1930, the weekly wages were reduced by 2*s*., but more recently they have returned to 30*s*.

It will be seen that the weekly cash wage has increased by more than 100 per cent. since the end of the last century. At the same time the hours of labour have decreased, for in pre-War days, not only did the labourer work six full days a week, but his hours were longer, and Christmas Day was, apparently, the only holiday in the whole year. When one considers his long hours of work, and the fact that his low wage meant often that he could only afford one meal of meat a week, and that for the rest of the week he fed almost entirely on bread, cheese and dripping, one can understand Rider Haggard's saying of the Suffolk farm labourers in 1900[1] " . . . all the courage and hope have been crushed out of their natures. They have nothing to look forward to, so they look forward to nothing."

The wage rates shown in Table VII are the weekly cash wages, and no allowances have been made for any extras or perquisites. It is intended in the following paragraphs to point out any difference between "weekly wages" and the "total earnings." The bailiff gets his house rent free and, until fairly recently, 1 lb. of butter per week, as well as an annual gratuity, which custom dictated should be equal in value to the average current price of a fat hog; actually, however, this gratuity amounted to £5 or £10, which was above the selling price of any hog. Furthermore, the bailiff received a bonus on all sales of poultry and dairy produce. The position with the poultry is the same now as it always has been, viz., that the master provides the food, stock-birds and houses, while the bailiff uses this material to the best advantage, and keeps careful account of all sales of eggs and birds. On these sales he receives a bonus of from 2*s*. to 4*s*. in the £. When most of the milk was sold as butter, the bailiff (or his wife) was remunerated for work in the dairy by a bonus of 2*s*. in the £ for all sales of cream and butter, while more lately a bonus has also been paid to the bailiff at the rate of 6*d*. in the £ on all sales of liquid milk.

Over the whole period the annual cash earnings of the bailiff have been, on an average, some 80 per cent. higher than his annual wage. As no attempt has been made to assess the cash value of any perquisite, house rent, butter, etc., given in kind, it is obvious that the figure of 80 per cent. underestimates the difference between the wages and the total real earnings of the bailiff. Before the War, bonuses, etc., represented 30 per

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[1] *Rural England*, Vol. II (Longmans).

cent. of the total earnings, but in post-War years they have accounted for more than half the bailiff's total cash receipts.

It is interesting to see what extras the day man received over and above the weekly wage given in Table VII. When work was "put out" (*i.e.* at piece work rates) he had a chance to earn a little above the weekly wage, but it is said that although the men worked harder on piece work they found it difficult to earn very much more than the usual day pay, and that, generally, this type of work was not popular. Some of the piece work rates up to 1905, were: muck spreading 1*s*. 6*d*. per acre; chopping out roots 3*s*. 6*d*. per acre; "seconding" roots 4*s* per acre; mangold pulling 4*s*. 6*d*. per acre. These figures are all very low compared with modern rates. The men used to get extras in the form of beef at Christmas, 4*d*. per day for threshing, and beer and a little extra money at haysel. Apparently, a married man received up to 7 lb. of beef, whereas single men and boys received quantities varying from 2 to 4 lb.

Harvest time, however, was the chief occasion on which the day men, and, of course, the other men, got a chance to earn extra money, which was generally used for the purchase of boots and clothing and for the payment of rent. At harvest a "company" was formed, consisting in the early years (up to 1913) of six men and two youths, who entered into a contract with the master to "see the harvest in." To bind the contract each man received earnest or "binding" money of 1*s*. before harvest, and once a man had received his earnest money he was obliged to stay until harvest was finished; this safeguarded both the master and the other members of the company. The harvest money before the War varied from £7 10*s*. up to £9 for a full man, with corresponding rates for youths.

Beer was brewed in cottages and drunk in relatively large quantities in the earlier days, and to encourage the men at harvest they were each given some malt to provide themselves with beer. In this neighbourhood it was a general practice, last century, to give three bushels of malt and three pounds of hops to each man, but on this farm the allowance was always four bushels of malt and no hops. In the very early years of this study 2*s*. 6*d*. to 5*s*. was also given to each man at the end of the harvest as "dinner money". The practice of paying each man his "earnest money" was discontinued before the War, and no malt was given after 1920. The latter custom probably survived longer on this farm than on most in the neighbourhood, where the practice of allowing each harvester his malt was discontinued, generally, before the War. Since the beginning of the War, a different basis has been adopted in paying for the harvest. In 1917, it was paid for at the rate of 70*s*.

per week. More lately the harvesters have worked a specified number of hours in the week, and have received at the end of the harvest a bonus amounting to about £5. These facts are mentioned to show the changes that have taken place in the harvest customs during these years.

The baiters received the same perquisites and extras as the day men, but, as well, they have always lived rent free, and a bonus of 20*s.* has been paid to each for every live foal born to a mare in his team. In the earlier years, as there were no bullocks to feed during the late summer, the stockmen could "take a harvest" with the other men. More recently, the stockmen have had, of course, their duties to perform in the dairy, and so have been able to help in the harvest field only for an hour or so each day. It must be pointed out that the cowmen's wages are considerably above the minimum rate laid down by the Agricultural Wages Board, and also that the milk roundsmen, because they come under the Board of Trade regulations, have weekly wages which are nearly double those of the day men.

The bailiff then, in particular, has been the recipient of several perquisites, but even the ordinary labourer was able, in the earlier years, to add to his weekly wage. In recent times, the weekly wages of all classes of workers, except the bailiff, have been much more representative of the total earnings than they were formerly.

Financial side of the Labour Bill.

There are two chief causes of all the features that will be pointed out in the following paragraphs, and, if they are made clear at the outset, it will be unnecessary to make continual reference to them. They are, firstly, the rise in weekly wages paid to all classes of workers, and, secondly, the alterations in the general farm policy which have led to considerable changes in the labour organization. The labour bill includes no charge for the occupier's own work.

In pre-War days the wages bill was fairly consistently equivalent to about £2 per acre, though a small upward movement was apparent after 1907, coincident with the slight rise in wages. Labour accounted for 25 per cent. of the total expenditure in the first thirty-seven years covered by this study, and from Fig. 3 it can be seen that the actual percentages (for the five-yearly periods) varied from 18 per cent. to 30 per cent. due, partly, to absolute changes in the wages bill and partly to alterations in the amount and value of other purchases.

After 1914, the labour bill per acre increased, slowly at first then more rapidly, until in the period 1917–21 it had reached £5, and in 1920 actually exceeded £6. The high

labour requirements of seed root-crops, and the fact that labour was required to clean the land that had been taken on at that time, accentuated the effect of the general rise in wage rates. Though wage rates have fallen since 1920, the total labour bill of the farm is still equivalent to nearly £5 per acre. Not only has the absolute amount spent on wages (£'s per 100 acres) more than doubled since the War, but this item has, in the last twenty years, represented as much as 38 per cent. of the total charges.

Purchases of malt, bonuses, and Employer's Liability and National Health Insurance contributions (by the employer) are included in the labour bill. Malt usually amounted to some 2–3 per cent. of the total wage bill. The first records made of the payment of Employer's Liability and National Health Insurance were in 1900 and 1912 respectively. The former, which in 1900 amounted to a total of only 18*s*. and has now increased to £13, is still a very small item in a wage bill of nearly £2,000. The National Health contributions (which from 1912 to 1919 were paid entirely by the occupier on this farm), have increased from 4*d*. to 1*s*. 6*d*. per week per adult worker. These now represent a total of £84 per annum, of which half is paid by the farmer.

Rent, Rates and Tithe.

The annual rent for each of the various periods is given in Table VIII. In addition, there is shown the tithe rentcharge up till 1891, when the payment of tithe was transferred from the tenant to the landlord.

TABLE VIII.

The Rent per Acre and Tithe Rentcharge up to 1891.

Years (inclusive).	Rent per acre.	Tithe per acre.
1877-84	35/-	6/- to 5/3
1885-88	27/-	5/3 to 4/6
1889-91	19/-	4/6 to 4/3
1892-94	23/-	—
1895-1902	21/-	—
1903-17	22/-	—
1918-20	21/-	—
1921-27	20/-	—
1928-31	15/-	—
1932-33	13/6	—

Although from 1891 to 1899 both rent and tithe were debited as separate items against the farm, this course was adopted for convenience in book-keeping, rather than as a departure from the landlord-tenant relationship, for the occupier thought that the 1891 scale of rent plus tithe represented a "fair rent" for the period. The sum of the rent and tithe in 1899 was taken as the "fair rent" for several years afterwards, despite

the subsequent rise in the value of tithe. The table illustrates the reductions that were made during the depression of the 'eighties and 'nineties, and in view of the large number of losses recorded, it is apparent that they were justified by the existing conditions. Rent reductions brought the charge down, in 1895, to 60 per cent. of its 1877 level, when in addition the tenant had to pay tithe. The fall in tithe rentcharge from 110 in 1877 (or 6*s*. per acre) to 76 in 1891 (just over 4*s*. per acre) eased the position of the tenant, but even a sum of 4*s*. per acre was a consideration in those hard times. The slight rise in rent shown for the years 1891–94 is due to the adoption of the basis of rentcharge already explained, but it can be seen that a reduction was soon made.

During the first twenty-seven years of the twentieth century there were only small fluctuations in the rent. Even in the last years of the War, and those immediately following it, the rent remained practically unaltered. As at this time some 150 acres of practically derelict land were taken over, any rise in rent on the rest of the farm would, of course, be obscured by the relatively low value of the new land. Since 1928 two further reductions in the rent have been made, bringing the charge down to the extremely low figure of 13*s*. 6*d*. per acre in 1931.

It is of interest to contrast the changes in the rental value of this farm with those which have occurred elsewhere. If the figures given by Thompson in the Minutes of Evidence of the Royal Commission on Tithe Rentcharge are compared with those shown in the table, it would appear that both show the same general trends and movements, except that on this farm there was no rise in the later War and immediate post-War years. The latter fact has already been commented upon. Further, the rent of this farm has fluctuated more widely than those given by Thompson. The *Richmond Report* states that good mixed land in Suffolk, in 1880, had a rental value of 30*s*. to 35*s*. Reference to Royal Commission Reports and other sources would lead one to believe that, in general, rents have been reduced in a proportion similar to that on this farm. In Haggard's *Rural England*, examples are given which suggest that many rents in Suffolk were halved between 1880 and 1900. The decrease since 1928 on this farm has, however, been somewhat greater than that found generally. The following figures show how far the decline in rent has reduced the relative importance of this item of cost: in 1877–99 rent accounted for 15 per cent. of the total charges; in the next seventeen years the percentage was reduced to 12, while, since 1917, the comparable figure has been only 7 per cent.

Previous to 1891 it was the legal duty of the tenant to pay

tithe, which at that time accounted for some 2 or 3 per cent. of the total costs. In 1883, when tithe was approximately at parity, it accounted for 2·5 per cent. of all the charges. Local rates, which for the first nineteen years of this study amounted to 2*s*. 6*d*. to 3*s*. per acre, were halved by the Act of 1896. While the immediate effects of this Act were to reduce the charge considerably, yet from that year the rates rose slowly, owing to the increasing rate per pound, and reached their 1896 value in 1919. After the War larger demands on the rate-payer resulted in further increases, and in 1923, when the contribution from agricultural land was halved again, the rates amounted to as much as 4*s*. per acre. Since 1923, further concessions have been made to the farmer: after 1925, rates were no longer payable on farm buildings, and, finally, in 1929, all agricultural land was derated.

Without a doubt the legislation dealing with de-rating of farm land and buildings has been most welcome, but reference to Table IX will show that rates have never been a large part of the total expenditure on this particular farm. In *Foundations of Agricultural Economics*, Venn quotes figures taken from a large number of farms between 1883 and 1894, which indicate that rates represented an average of 3 per cent. of total outgoings An investigation by Howell, in 1918, confirms the fact that, at this later period, rates were still an unimportant part of the total charges.

TABLE IX.

RATES AS A PERCENTAGE OF THE TOTAL CHARGES ON THIS FARM.

Period.	%
1877-1896	2·1
1897-1923	1·1
1924-1929	1·0
After 1929	0·2

The table shows that the halving of the rates, in 1896, reduced the incidence of this item of expenditure, though, of course, these percentages do not reflect the absolute changes which occurred. The last figure in the table shows the effect of the 1929 legislation.

One can now review the positon of the tenant through these years as regards his expenditure on rent, rates, etc. The low commodity prices of the 'eighties and 'nineties made it impossible to continue paying the high rents of the prosperous corn times of the "Golden Era," and so rent reductions became necessary: but, as Ernle and others have suggested, these were often made too late. Added to the relatively large rent during the early 'eighties, the tenant had to pay tithe and rates ranging in total from 6*s*. to 8*s*. per acre. Aided primarily by the inevitable fall in rents, the position of the tenant, as

regards the charges on his land, was further improved by legislation, which transferred the payment of tithe to the landlord, and also lightened, and finally removed, the burden of rates. Fig. 3 shows how rent, rates and tithe have, since 1877, become a less and less important part of the farm expenditure, and that they now constitute only 7 per cent. of the total charges instead of 19 per cent. as was the case in the last years of the nineteenth century.

ECONOMIC DATA.

Gross Output.

The gross output represents the value of products manufactured on the farm and is calculated on the general formula :— total sales less purchases of live-stock *plus* or *minus* the change in valuation. At this juncture it may be well to point out that alterations in the value of gross output do not necessarily imply comparable changes in that of the net output.

In column (1) of Table X the value of the gross output per acre for the five years 1878–82 is taken as 100, and the corresponding figures for the other five-year periods are shown on this basis.

TABLE X.

GROSS AND PHYSICAL OUTPUT PER 100 ACRES.

Period.	Value of Gross Output per acre (1).	Estimate of physical output (2).	Period.	Value of Gross Output per acre (1).	Estimate of physical output (2).
	Index.	Index.		Index.	Index.
1878-82	100	100	1908-12	103	125
1883-87	84	103	1913-17	222	161
1888-92	74	90	1918-22	169	93
1893-97	66	91	1923-27	143	113
1898-02	77	105	1928-33	132	131
1903-07	94	123	—	—	—

The fact that the figure for the first five years (column (1)) is higher than those immediately following is due, partly, to a greater use of home-grown food stuffs in the later years (especially in the two periods 1888–92 and 1893–97). The result of this was to reduce the income from cereals and pulses as well as to lessen the expenditure on purchased foods. The relative values in the table follow general price trends. The effect of high War-time prices was accentuated by the larger pig sales and the large return from seed roots. The figure given for the post-War years (1918–22) reflects falling valuations. The gross output per acre, since 1922, has been higher than that of pre-War years, a change which, undoubtedly, is the result of the change from bullock- and sheep-fattening to dairying and pig-feeding.

If the gross output be corrected for changes in price level, some idea may be obtained as to the fluctuations in the physical output per acre. An attempt has been made to do this and the results are given in column (2) of Table X, where 1878–82 is taken as the basal period, indicated by a value of 100. The method adopted is open to criticism, for the index of agricultural prices published by the Ministry of Agriculture commences only from 1906, and has had to be projected back from 1906 to 1878 on the basis of the index of wholesale prices given by Sauerbeck. This is, admittedly, an unsatisfactory method of calculation (particularly in connection with an individual farm), and the resulting figures must be accepted with considerable caution. For what they are worth, however, these estimates suggest that the physical output of the farm declined from 1877 to 1897 and rose during the ensuing twenty years, reaching its maximum in 1913–17. The very great decline in the index of physical output, which occurred immediately after the War, was due, partly at least, to the taking over in 1918 of some 150 acres of impoverished land, but productivity has been again increasing during the final eleven years of this study. In connection with the changes in the physical output of the farm, reference should be made to the description of alterations in the organization, and in the size of the farm itself, given in earlier sections of this article.

By expressing the value of the gross output as a percentage of the farm capital, a rough measure of the rate of capital turnover is obtained. (Table XI).

TABLE XI.

THE RELATION OF OUTPUT TO CAPITAL.

Period.	Gross Output as percentage of Farm Capital. (1)	Percentage of gross income represented by receipts from :— Sheep, Bullocks, and Wheat. (2)	Dairy Produce and Pigs. (3)
	%	%	%
1878-89	54	64	13
1890-99	59	56	16
1900-13	77	49	26
1914-19	88	21	49
1920-33	81	15	66

In columns (2) and (3) of the table are shown the most important items of income in each of the periods, and these latter figures provide some indication of the causes underlying the increasing rate of capital turnover apparent in more recent years. Thus bullocks and wheat—typical products of the old system—give a comparatively low rate of capital turnover, whereas dairy cattle and pigs produce a more rapid turnover.

The lag between costs and prices (and hence between costs and valuations), as well as larger pig sales and sales of root seeds, are responsible for the relatively high rate of capital turnover secured during the War years.

Labour Output.

It may be of interest to show the changes which have occurred throughout the fifty-seven years in the value of the output obtained from every £100 spent on labour. It must be pointed out that this comparison, which is a good indication of the relative efficiency of labour on two similar farms in any one year, is of limited value as a measure of varying efficiency over such a long period as is dealt with here, for it fails to make any allowance for alterations in wage rates, commodity price levels, or the value of money. Some attempt will be made in subsequent paragraphs to make adjustments for the first two of these factors.

The output per £100 spent on labour is given in column (1) of Table XII, and considerable variations are apparent between one period and another. One thing is clear, however, that the output for every £100 spent on labour has been considerably less since the War than it was even in the low-price period of the 'eighties and 'nineties of last century. But, if the units of labour employed are expressed in terms of numbers of workers rather than in pounds sterling (*i.e.* if allowance is made for the changes in wage rates which have occurred), a different relationship between labour and output will be observed. The "day man," or ordinary labourer, has been adopted as the "worker unit," and the number of worker units has been calculated by dividing the total wage bill by the value of the annual earnings of an ordinary labourer. This unit, of course, fails to make allowances for changes in the proportions of the "high-pay" and "low-pay" workers through the period, and hence may be open to some criticism. It is possible to assess with reasonable accuracy, from his weekly wage and harvest money, the annual earnings of the day man. For the War period the estimates are, perhaps, not so accurate, as wage rates changed very frequently; but it would appear that the annual figures taken, even in these years, are fair approximations.

Table XII shows both the gross output and the physical output per worker unit, which latter has been calculated from the gross output by correcting for alterations in price level of commodities sold. The values for the physical output must be accepted with the reservations that have been mentioned in a previous section (*vide* section on Gross Output). The gross and physical outputs per worker unit for the years 1877–82 have been taken as equal to 100.

TABLE XII.

GROSS OUTPUT (IN POUNDS STERLING) PER £100 SPENT ON LABOUR AND PER WORKER UNIT, AND PHYSICAL OUTPUT PER WORKER UNIT.

Period.	Gross Output (£) per £100 spent on labour. (1)	Gross Output (£) per worker unit. (2)	Physical Output per worker unit. (3)
	Index.	Index.	Index.
1878-82	100	100	100
1883-87	96	90	112
1888-92	82	78	96
1893-97	75	77	108
1898-02	77	77	105
1903-07	88	89	116
1908-12	96	99	123
1913-17	122	184	133
1918-22	73	196	108
1923-27	66	144	114
1928-33	65	144	143

From the method of calculation employed it is obvious that, if the wage rates had remained constant, then the variations between one period and another in both columns (1) and (2) of Table XII would have corresponded. Up till the period 1913–17 there had been no large changes in the annual wage of the day men, and the table shows, as might have been expected, that the figures given in columns (1) and (2) are roughly equal. But since the rise in wages during and after the War, the index of the gross output from each worker unit has been greater than the corresponding index of the gross output per £100 spent on labour, and in the last sixteen years the figures in column (2) have been more than double the corresponding ones in column (1). This is coincident with a rise in wages of over 100 per cent.

A glance at Table XII shows that although the value both of the gross output and of the physical output per worker unit has varied from time to time, it is the former which has fluctuated more widely. A comparison of columns (2) and (3) makes it clear that the decline in the value of the gross output per worker unit during the years 1882–1903 is due to low prices rather than to a fall in the physical output. During the ten years 1908–1917 the physical output (column 3), rose, and it will be recalled that during these years a change was made from bullock- to pig-fattening. The high prices ruling during the War years are also reflected in column (2) for the two periods 1913-17 and 1918-22. The employment, after 1918, of a considerable amount of labour in cleaning the land that had been taken over at the end of the War, resulted in a lower physical output from each worker, for the effects

of the labour, thus expended, would not be immediately apparent in column (3). In the last six years, the physical output from each worker has increased markedly. This has been due both to the pig-feeding and dairying methods of recent times, as well as to the labour-saving machinery and methods which have been introduced. It is by these means that the occupier has been able partially to offset the rise in wages which has taken place since the War. It should be pointed out that, as the hours of work have been reduced since 1917, the physical output per *hour worked* must have increased to a greater extent than that of the worker unit. For, if the hours worked per week in the earlier years were sixty, and, in more recent times, fifty, then, assuming that the physical output per worker was 100 in both periods, the output *per hour* would be 20 per cent. higher in recent years than previously. Thus the indices shown in the third column of the table underestimate the increase which has taken place in the physical output per hour worked.

Net Output.

The net or social output represents the amount accruing to the three partners of the farm business—farmer, landlord and labourer—and is calculated by summing the profit, the rent and the wage bill. These three items have already been discussed individually, but it is of interest to examine the variations which have occurred both in the amount and distribution of the net output. It may be well to point out that while the occupier's share will be negative when the farm makes a loss, the share obtained by both the landlord and the labourer must always be positive. Thus, under certain circumstances, the sum of the proportions of the total net output obtained by the landowner and worker will exceed 100 per cent.

During the fifty-seven years covered by this study the net output has averaged nearly £5 per acre or £84 per worker unit, and, with the exception of the post-War years, the trend has been consistently upward. Table XIII shows that during the twenty years following the outbreak of the War, the total net output, both per acre and per worker unit, was almost twice as high as it had been in the preceding thirty-seven years. Thus it can be seen that the money value of the income available for distribution amongst the three partners has been increasing. It is, however, important to note that the share which each has received has undergone considerable alteration from time to time.

Whereas the landlord's share has shown a fairly regular decline—in pre-War years he obtained 33 per cent., but since the War his part has only amounted to 14 per cent.—that of

TABLE XIII.

AMOUNT AND DISTRIBUTION OF THE NET OUTPUT.

Period.	Net output per 100 ac.	Per Cent. Distrib. of Net Output.			Net output per Worker Unit.
		Labour.	Landlord.	Farmer.	
	£	%	%	%	£
1877-89	322	63	46	(—) 9	60
1890-99	336	58	31	11	65
1900-13	424	57	26	17	69
1914-19	1,176	41	9	50	187
1920-31	538	92	17	(—) 9	88
1932-33	673	67	11	22	112
Averages.					
1877-13	364	60	33	7	65
1914-33	733	69	14	17	120
1877-33	494	66	20	14	84

labour has increased. The change which has taken place since the War in the distribution of the net output between these two partners is emphasized by a comparison of their respective shares in the two periods, 1877–89 and 1920–31 in both of which the occupier's share was represented by (—) 9. As for the occupier, it is clear that his share of the net output has fluctuated markedly from period to period. This is to be expected, as, of the three partners, the occupier takes the greatest risk, and thus stands to lose most in lean periods and takes, as he is entitled to do, the bulk of the increase in more prosperous times.

SUMMARY.

The generalization is often made that, during the course of the last thirty years, farming systems have undergone modification: this study illustrates the way in which reorganization has been carried out on a particular farm. An attempt has been made, both in the text and by the aid of diagrams, to point out the effects of the changes in policy on the whole farm economy, and it is evident that they have been considerable. One section of this article has been devoted to the labour bill—an item of both economic and sociological interest, and the influence of an innovation of recent times (*i.e.* statutory minimum wages) has been shown. Obviously, it is impossible to draw from one isolated farm any general conclusions as to the state of the industry as a whole during the last five or six decades, but information contained in this article does add weight to the contention that the return from farming during these years has been small.

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THE TECHNIQUE OF EARLY FIELD EXPERIMENTS.

IT is only proper to say that the first field experiments made by our ancestors had no technique. So little was known of the factors involved in the cultivation, manuring and growth of plants, that the veriest accident would lead to the adoption of a principle. For instance, the advantage of spacing plants and keeping them hoed must have been known to practical men in many countries, but the field crops were invariably broadcast. "Happily" however "some sillie wench, having a fewe cornes of wheate, mixed with some other seed, and being carelesse of the worke shee had in hand, might now and then instead of a Raddish or Carret seede, let falle a wheate corne into the ground, which after branding itselfe into manie eares, and yeelding so great encrease, gave just occasion of some farther triall"; but "the first man that ever attempted the setting of corne, made the first holes with his finger."[1] Nearly a hundred-and-fifty years passed before a practical seed-drill was invented, and many more before it was adopted very widely; but the first man's trial of dibbling seed in holes made with his finger must have been a very primitive experiment, and its only control the innovator's acquaintance with crops growing in the field. However, he was clearly no scientist, not even in the sense of his contemporaries.

A man like Bacon, contemporary of Platt and the father of modern science, had a clearer view of what was necessary. He included in a curious experiment (an early attempt at "vernalization") a control untreated with any of the very varied concoctions with which he steeped his unfortunate seed. He may be allowed to describe the experiment in his own inimitable style.

[1] Sir Hugh Platt. *The newe and admirable arte of setting of corne*, 1601, Chap. I.

"There were sowen in a *Bed, Turnip-Seed, Radish-Seed, Wheat, Cucumber-Seed*, and *Pease*. The *Bed* we call a *Hot-Bed*, and the Manner of it is this. There was taken *Horse-Dung*, old and well-rotted; This was laid upon a Banke, halfe a foot high, and supported round about with Planks; And upon the Top was cast Sifted Earth, some two Fingers deepe; And then the *Seed* was sprinkled upon it, having been steeped all night in *Water* Mixed with *Cow-Dung*. The *Turnip-Seed* and the *Wheat* came up halfe an Inch above Ground, within two Dayes after, without any Watring. The Rest the third day. The *Experiment* was made in *October*; And (it may be) in the *Spring* the *Accelerating* would have been the speedier. This is a Noble *Experiment*; For without this helpe, they would have beene foure times as long in coming up. But there did not occurre to me, at this present, any vse thereof, for profit; except it should be for sowing of *Pease*; which have their Price very much increased, by the early Comming. It may be tried also with *Cherries, Strawberries* and other Fruit, which are dearest, when they come early.

"There was *Wheat*, steeped in *Water* mixed with *Cow-Dung*; other in *Water* mixed with *Horse-Dung*; other in *Water* mixed with *Pigeon-Dung*; other in *Water* mixed with *Soot*; other in *Water* mixed with *Ashes*; other in *Water* mixed with *Bay-Salt*; other in *Claret-Wine*; other in *Malmsey*; other in *Spirit* of *Wine*. The Proportion of the Mixture was, a fourth Part of the Ingredients to the *Water*; Save that there was not of the *Salt* above an eighth Part. The *Vrine* and *Wines* and *Spirit* of *Wine*, were simple without Mixture of *Water*. The Time of the Steeping was twelve houres. The Time of the Yeare *October*. There was also other *Wheat* sowen unsteeped, but *watred* twice a day with *Warme Water*. There was also other *Wheat* sown *Simple* to compare it with the rest. The *Event* was; That those that were in the Mixture of *Dung*, and *Vrine*, and *Soot, Chalke, Ashes*, and *Salt*, came up within six dayes; And those that afterwards proved the Highest, Thickest and most Lustie, were; First, the *Vrine*; and then the *Dungs*; Next the *Chalke*; Next the *Soot*; Next the *Ashes*; Next the *Salt*; Next the *Wheat Simple* of itselfe, unsteeped and unwatered; Next the *Watered* twice a day with warme water; Next the *Claret Wine*; So that these three last were slower than the ordinary *Wheat* of it selfe; And this Culture did rather retard, than advance; As for those that were steeped in *Malmsey*, and *Spirit* of *Wine*, they came not up at all. This is a Rich *Experiment* for Profit; For the most of the Steepings are Cheape Things; And the Goodnesse of the Crop is a great Matter of Gaine; If the Goodnesse of the Crop answer the Earlinesse of the Comming up; As it is like it will; Both being from the vigour of the Seed; Which also partly appeared in the Former *Experiments*, as hath beene said. This *Experiment* would be tried in other *Graines, Seeds* and *Kernels*: For it may be some *Steeping* will agree best with some *Seeds*. It would be tried also with *Roots* steeped as before, but for longer time. It would be tried also in *Severall Seasons* of the *Yeare*, especially the *Spring*."[1]

Bacon here admits that his work was inconclusive and postulates various possibilities; but this is hardly a field experiment, and is cited only as an illustration of what was being done by the brightest of Jacobean investigators.

It was not till the early days of the Commonwealth that a real field-scale experiment was set out, and this was tested, as

[1] Francis Bacon. *Sylva Sylvarum, or a naturall history*, 1627, pp. 109–110.

possibly manurial experiments should be, on a very barren soil. The element of comparison is present in the effort, but essential information as to area of plots, quantities of the various manures applied, dates, amounts of seed sown and yields are missing. Visual judgment of quality and presumably quantity sufficed this observer for his conclusions, and verbal description of the work done is deemed adequate.

Blith relates that—

> "Upon an hard Inclosed Wood-land Farme I rented, having some Land also in Common, amongst the rest I had about fifteene or sixteene little short Lands, or Butts, lay all together in the Common Field; All which said Lands were so Gravelly of nature, that there was but about two inches of Earth before you came to as perfect Gravell as any High-way, yea, so exceeding herein, that in many places turned to Sinder (like that the Smith carts forth of his fire, . . .) and also so hungry and barren of nature that before I converted it to Tillage, little or nothing was made of it; And to graze it was not worth above two shillings an Acre, yet it was Resty and old Turfe, and had lain long, may be fifteene or twenty years; And resolving to make an Experiment I searched for Marle, and found it . . . was perfect Red, differing in nothing from Clay in colour, but in the breaking into bitts and ends like Dies, not slippery, as was discernible with Clay.
>
> "And because I would make an undeceiveable Experiment of it (which ever was my greatest Arrogancie) I carried forth that Mud (pond mud) also to my Land, and laid it upon two or three Lands, as thick againe as men use to lay on Soyle or Dung; I also Mucked with the Cart two more exceeding well, and as I remember Fold-Mucked two more; Also Marled three or foure farre thicker than I Mudded the other; And one Land I neither Mucked, Mudded, Folded, or Marled, nor laid any cart upon it at all, yet Plowed them all alike, and brought them into good Tillage, and sowed them as I remember with Wheat, and Rye mixed; and for the first yeare, I reaped very good Corne upon my Cart Mucked Land, and Fold Mucked the best of all, the best upon my Mudded Land the next, and upon my Marled Land reasonable good, not so good as the aforsaid sorts yeelded (because Marle yeelds not forth his utmost strength the first yeare). And upon that I laid nothing, I reaped nothing, no not so much as Straw, although I gave it the same seed, and the same Tillage as the aforesaid Lands . . .
>
> "The next yeare I sowed Barley upon all sorts of these Lands, and upon my Marled Land was most gallant Corne, and so was my Mudded Land, my Mucked Land was the worst by farre, the Muck decaying, and upon that I soyled not; I sowed the second yeare with Oates, and reaped nothing again that yeare also; Then afterward I Marled that which before I had Mucked, and that which had not Soyle laid upon it, and brought forth nothing the two yeares before, which brought forth as gallant Corne as *England* yeelded; And after three or foure Crops my Mud decayed also, and that I Marled againe, and had the same Fruit as aforesaid; And for my Marled Land that I kept in Tillage nine yeares, without any other addition of any Compact or Soyle at all, and had as goodly Corne as grew . . ."[1]

This experimenter was contemptuous of the facile promises made by some of his contemporaries. Adolphus Speed promised a

[1] Walter Blith. *The English Improver Improved*, 1652, pp. 136–137.

return of £30 an acre from growing turnips on sandy land, after paring and burning; if the roots were sold by weight and the tops for feeding cattle.[1] Of this Blith says "These things are gallant in contemplation, but more sadly experimented, which you shall hardly see by sea or land, nor any other place but Mr. Speed's chamber, I believe."[2]

It was nearly a hundred years later before any further experiments were recorded, and these were the efforts of the renowned Jethro Tull. Tull's reputation should depend more upon his attempt to construct a drill plough than upon his field trials, which were in fact designed to prove his theories of plant nutrition. They were on a field scale and were, judged by modern standards, quite uncritical.[3] Young, who commented pretty adversely on most of the experimental work done before his day, does not think too badly of these trials, but is more impressed by the exactness shown by the Rev. Wm. Harte in his trials of transplanted lucerne, by those by Robert Billing on carrots, and the work of John Wynne Baker.[4] Harte's experiments on transplanted lucerne need not perhaps detain us here,[5] but Billing's work was of a different calibre. A good deal of objection can be taken to his work because the plots were single, and were of widely varying area. Of the three one was 13a.; one ½a.; and one 17a., the last of which, owing to a readily appreciated soil divergence, might well have been divided into two. The previous cropping and a statement, though not a quantitative one, of the improvement of some part of the land by marl, are supplied. Billing does give some of the essential details. He mentions the seed sown and the yield obtained, but the final comparison of results is inadequate.[6]

Young also takes exception to the work of Du Hamel de Monceau and his fellow-countrymen, which is, however, pretty carefully defined by the standards of the time.[7] Of these Young says "Mons. Du Hamel de Monceau in the several volumes[8] he has published, has inserted a great number of experiments, made by himself and his friends, in the old and

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1 Ad. Speed, Gent. *Adam out of Eden*, 1659, p. 18 ff.

2 *Op. cit.*, pp. 174–175.

3 Cf. *The Horse Hoing Husbandry*, 1733, p. 128 *et passim.*

4 *A course of experimental agriculture*, 1770, pp. x, xvi, and xvii.

5 Cf. Walter Harte. *Essays on Husbandry*, 1764, p. 26 ff.

6 Robert Billing. *An Account of the culture of carrots*, 1765, p. 4 ff.

7 See *A practical treatise on husbandry*. Tr. by John Mills, 1765, p. 113 ff.

8 Young cites Traité de la culture des terres 6 tom. Experiences et reflections sur la culture des Terres, 1750, 1753 et. Elemens d'agriculture 12 mo. 3 tom.

the new husbandry, upon most of the field vegetables. These works have been praised so greatly by other writers, that some may imagine that they preclude the want of fresh experiments : it is therefore necessary to give them a little attention.

"M. du Hamel's experiments, and those of most of his correspondents, but particularly M. De Chateauvieux, ought, in many respects, to be considered an excellent model for future essays. They are generally concise, admirably expressed, and great attention paid to most concurrent circumstances. I heartily wish we had as large a collection of equal authority made in England.[1] But whatever praise we give to the patriotic individuals who made these experiments, yet there are some circumstances omitted in relation to them, which are of great importance."

They do in fact give full details of the culture employed and of the produce obtained, but none of the expenses incurred nor the prices obtained for the crop. Chateauvieux supplies details of the ploughings, seed, horse hoeings, and quantity reaped, and makes a comparison between this system and the average produce obtained by the methods commonly employed. Young takes exception to this on the ground that, while the cash profit is unequivocal, the yield alone shows nothing ; he goes on to express the opinion that "It is impossible for single experiments, or from a great number in different lands separately considered, to deduce a satisfactory proof of the superiority of any method." He disdains experiments for one or two years and calculations for many years based upon them.[2]

"No comparison here" (in England), he continues, "can be decisive, unless it is conducted during several years, and an exact register and account kept of each method during the whole time."

He has quite an enthusiastic opinion about John Wynn Baker, whose experiments, he says, "merit the utmost praise ; all that I have seen published are judicious, important, accurate and conclusive ; I heartily congratulate our sister kingdom, upon possessing a cultivator, whose ideas are so enlarged, and whose registers are so satisfactory."[3] Baker had been supplied with a farm by the Dublin Society for the purpose of carrying out trials designed to determine improved methods for the farmers of Ireland.[4] He carried out many types

[1] For a complete discussion of this question, see T. H. Marshall, "Jethro Tull and the New Husbandry of the 18th century," *Econ. Hist. Rev.*, II (1929), p. 41 ff.

[2] *Experimental Agric.*, pp. xi and xii.

[3] *Ibid.*, p. xvi.

[4] Cf. the author's "John Wynn Baker : an improver in 18th century Ireland," *Agric. Hist.*, V (1931), p. 151 ff.

of experiment on many crops, and he invented or adopted improved farm implements, which he put on the market.

Experiment before his day had been concerned mainly with methods of cultivation. The controversy about the drill husbandry had been going on for long enough, and pretty well all the didactic writers treated of it. More than anything else advanced farmers were thinking about this subject. Manures were of the accepted kind, mostly organic, although some soot and ashes were used, and the use of varieties in particular districts was practically stabilized. Baker's experiments expanded the field of enquiry, but most of them are open to the same objections as those which Young levelled at the work of Chateauvieux. Baker's trials were on a field scale, and although he supplies a great deal of detail (including the all-important costs and returns) he does not fail to base his estimates of financial return, over a number of years, upon a single year's experiment.[1]

Baker did, however, set out variety trials. In 1768 he tried blue cone, red (red lammas ?) and white wheat sown in alternate rows upon the same ground. He supplies details of the cultivation and states that the land had received no manure since before 1764 because it was the experimental field on which he had been trying out his comparisons of the drill husbandry. The yield is given, and Baker's observations afford the conclusions.[2] Later he carried out similar trials with six varieties of turnips and with cabbage. These were continued for two years, and a table of results is given showing the yield of each variety in each year. On the basis of these trials he calculates the acreable produce of each variety and notes his recommendations. He also tried to lay out some rotation experiments, but all of these lack some necessary information, and the results are obviously applicable only to a particular place and time.

One of the most detailed of the multitudinous cultivation experiments of the day is not mentioned by Young, and this is odd because he was an omnivorous reader as well as a voluminous writer. Sir Digby Legard began some trials in 1768 and continued them for several years over a series of rotations. Costs and receipts for each crop at current prices are added, and the whole reported to the Royal Society of Arts. The first season's work is described verbally :—

> "Five acres of an inclosed field, the soil of which was naturally pretty rich, but light and dry, inclining to an hazel mould, and nearly of equal goodness throughout, was destined to be sowed with barley :

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[1] See *Experiments in Agric.*, 1766, p. 30.

[2] *Ibid.*, 1768, p. 39 ff.

part according to the old and part to the new method of husbandry, in order to ascertain the most advantageous method of culture. This land had borne four successive crops viz., one of barley, two of wheat, and one of turneps; was disposed in beds from the first; and had been horse hoed every year; but it never had any manure; except that the turneps had been eaten off by sheep. On the 26th April 1763, half an acre was sowed by hand, in the random way; and took five pecks of seed: and half an acre was drilled, in equal distant rows, one foot asunder; and took three pecks. Two acres were drilled on ridges or beds, five feet broad, in double rows, one foot asunder, and four feet one inch interval to be horse-hoed; and they took six pecks. Two other acres were drilled, on five feet ridges, in treble rows, seven inches asunder: and took four pecks.

"N.B.—I feared, at the time of sowing these last two acres, that the seed had been too sparingly dispensed: but the plants branched so much afterwards, that the rows seemed tolerably compleat.

"The above five acres had but one ploughing, viz., just before seed time after the harvest, 1762. On the 30th May, the first horse-hoeing was performed, on the four acres, sowed in ridges, with M. Du Hamel's one-wheeled plough. But on account of the rows having been drilled unevenly, this could not be done very regularly in some places: the plow coming so near the rows as to tear out some plants, and cover others with mould; and in others going at too great a distance from the corn. To remedy this in some measure, the rows so covered had the earth raked off: and another horse hoeing was given on the 7th of June; the earth being very dry. By this last operation the furrow was cut deeper: and the plow went at a proper distance from the rows. On the 8th of June, all the five acres were hand hoed. But by reason of the dry season, not many weeds had sprung up. The effect of the horse hoeing on the four acres was great: and the corn seemed to flourish exceedingly. The plants were of a deep green; and remarkably vigorous. The part drilled in equally distant rows without intervals remained always of a paler green. But the part sown in the common way was a degree still paler; tho' this last ripened the earliest; the drilled half acre next; and the four horse-hoed acres last of all. The third and last horse hoeing was performed in the beginning of July. This turned the earth towards the rows; and left a furrow in the midst of the intervals.

"On the 31st August 1763, the ½a. sowed by hand, and the ½a. drilled in equal distant rows, were mowed. The first produced 27 stocks; the latter 31 stocks and 8 sheaves, and the straw was stronger and the ears larger, in the latter than the former. On the 15th September the 4a., that had been horse hoed, were mowed. The ears were far from being equally ripe, because the extreme wet season had caused several fresh shoots at the time the first, and principal, were ripening. The two acres drilled with treble rows produced 94 stocks and 4 sheaves. But the seed was sowed too thin; and, in consequence, there were several vacant spaces in the rows: and this was certainly some diminution of the crop. The two acres drilled with double rows produced 95 stocks. The ears of barley, throughout the four horse hoed acres, were surprisingly large. Several contained 38 grains each (which is uncommon, at least in my neighbourhood). I believe the number of grains, in an ear, were, at a medium, about 30."[1]

[1] Robert Dossie. *Memoirs of agriculture*, I (1768), p. 324 ff.

Few persons up to this time had recognized the use of pot experiments for checking up the data obtained from field trials, although some chemists had attempted by this method to determine the principles of plant nutrition.[1] One ingenious writer, however, had invented a specious dope, none too definitely described, and made a comparative trial of his material with others in four pots.[2] He believed that the results obtained were convincing and proclaims with unction in another place that "Experiments correctly made, and fairly related, form the data on which agriculture should be founded. To plan an experiment well, to trace it minutely through its progress, and to draw a just conclusion, is expected from the philosopher. And yet experiments that spring from chance more than reason should not be neglected."[3]

Young, of course, entirely agreed with him, and felt that all the experimental work which he so scathingly reviewed had been so unsatisfactory as to induce him to believe the subject to be by no means exhausted, a conclusion which, on perhaps more definite grounds, can hardly be bettered to-day. The work he did himself is extremely varied. He does not only make the usual comparison between the drill and broadcast husbandry; he was sufficiently convinced of the advantages of the former: but he tried various manures, varieties and dates of sowing. The details are given in full and the all important (to him) costs and returns are registered, but the work lacks the precision necessary to entitle trials to be regarded as anything more than demonstrations, although Young had a completer sense of the requirements of trials than most of his contemporaries.

The critical sense was nevertheless developing as time went on, and a few years after Young's book was published, a report made to the Bath and West Society called forth some ticklish questions. The report is concise.

> "About Michaelmas, 1774, a field of clover and ray grass stubble, containing 12 acres, was broken and ploughed into broad stetches (the land being sound and dry) which stetches were alternately set (dibbled) and sown throughout the whole field, and the corn after reaping was laid and carefully kept separate. On threshing, it was found that the Wheat which had been set produced 2 b. per acre more than the sown."[4]

The Secretary to the Society wished to know, amongst other things, the nature of the soil, how long the land had been

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[1] See Sir John Russell. *Soil conditions and plant growth*, 1932, p. 2 ff.

[2] Alexander Hunter. *Georgical Essays*, I (1770), p. 70 ff.

[3] *Ibid.*, IV (1772), p. 65.

[4] *Letters and papers on agriculture*. . . . . Bath and West Soc., I (1792), pp. 6–7.

under clover, how deep the seed was dibbled, the number of grains dropped in each hole, how many bushels per acre were harvested, and the quality of the straw. In spite of this powerful criticism and implied suggestion, this series of letters and papers reports numerous so-called experiments, which are chiefly remarkable for the lack of comparison with controls. They might more accurately be described as reports on crops.

Indications that there was no shortage of pious aspiration towards a precise experimental technique are plentiful. Marshall, who complains that comparative trials were few, adds his voice to the chorus. His own work was limited to single-year trials and he laid them down in ordinary fields on selected plots. The plots were treated in some special way and differently from the rest of the field, but usually the crops were the same. His own views of the way in which the work should be carried out are a little in advance of his time. The mode of making experiments he feels requires little explanation, but

> "It may be proper to observe, however, that *Circumspection* and *Accuracy* are indispensably necessary to the operation; the former to guard against any *dissimilarity of Soil, Seed*, etc., etc., with which the Experiment is about to be made; and the latter to mark minutely the *scene of Experiment*. When this lies in the *Field, labelled Stumps* are very *convenient*: but they should not be *implicitly depended* upon, being liable to being *removed*, either by accident or intention; the *place* should therefore be identified likewise by the number of Lands, quantity of Rods, etc. In short, *to make an Authentic Experiment*, an *identity* of *Place, Time, Element* and *Process*, must be strictly observed in every particular, excepting only the *Intended Difference* which constitutes the Experiment. Nor can the Experiment be *authentic*, if the Process be in any instance left to an *Agent*; it must be performed by the immediate hand, or under the immediate eye of the *Experimentalist*.
>
> "*The mode of registering experiments* . . . is of some importance. *The Accuracy of Making* is lost, if the Experiment be not *fully and* accurately registered . . .
>
> "Observing the results . . . is a very serious Employment . . . ."[1]

Young indeed thought that every farmer might have an experimental field on which experimental plots could be laid out for trying new ideas, seeds and manures, etc., in small before taking them upon a commercial scale. He also wished farmers to set up a simple laboratory for soil analysis and so on.[2]

This type of field plot was used for a long time,[3] but small comparative plots began to come into practice so early

[1] Wm. Marshall. *Experiments and observations concerning agriculture and the weather*, 1779, Intro.

[2] *Farmer's Calendar*, 6th ed., 1805, pp. 593–594, 563 ff.

[3] Thomas Crowe Munnings. *An account of some experiments for drilling and protecting turnips*, c. 1802. Cf. *Prize Essays and Trans. High. Soc.*, N.S.I. (1829), pp. 67 and 72, 317 ff; XIV (1843), pp. 327 ff.

as 1805, when John Wright of Pickworth, Rutland, undertook to conduct any trials that the Board of Agriculture might propose. The Board set him to work on ½ rood plots at trials of fresh stable dung, rotten stable dung, and burnt straw. He carried out these trials for some years and had an unmanured plot as control. The soil and subsoil and the course of cropping are described, while the yields, as well as the rates at which the various manures were applied, are set out in tabular form.[1]

It was unfortunate that one of Sir John Sinclair's most admirable projects came to naught just about this time. He had tried to form an Experimental Farming Society, but he could not obtain a charter, and without the measure of royal support which a charter would have indicated he abandoned it.[2] Sir John, while he admitted the value of the experiments being done by private individuals, thought them rather pattern farms for the advantage of the farmers in their immediate neighbourhood, and the records too often rather those of successful experiments only, rather than the faithful journals of success and disappointment. In order to render experimental farms generally useful, they ought to be open to the inspection of the public; the account of each experiment ought to be regularly published, and every new practice, likely to improve the cultivation of any part of the kingdom, ought to be examined with the utmost precision, every trial repeated for confirmation, and, if possible, made by different persons, in different places, and on different soils . . . . The object of an experimental farm should be to ascertain facts, *and to publish them*; and as much credit would be required, by an intelligent conductor of an experimental farm, for his exertions in detecting errors, as in establishing facts likely to be useful. Sir John thought a grant of £5,000 a year for ten or twenty years would be sufficient to secure his purpose.[3]

The work of Wright had its fruits at a later day. One-twentieth of an acre seems to have been recognized, by the forties of the 19th century, as a suitable size for experimental plots, and the essential control plot was then pretty generally laid down.[4] At this time a clear exposition of the best contemporary method of laying out experiments was made by James F. W. Johnston,[5] who thought the form of the

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[1] *Communications to the Board of Agriculture*, IV (1805), p. 407 ff; V (1806), p. 175 ff.

[2] *Farmer's Magazine*, III (1802), p. 375.

[3] *The Code of Agriculture*, 3rd ed., 1821, pp. 582–583.

[4] *Trans. High. Soc.*, N.S. (1843–1845), p. 28 ff; (1847), pp. 1 ff, 140 ff, 357 ff, 382 ff, 401 ff; (1851), p. 141 ff.

[5] *Experimental Agric.*, 1849, p. 38 ff.

pieces of land on which field experiments were laid down should be square or oblong because they are likely to be uniform in quality and are easy to handle. Experiments on two or more drills he thinks objectionable and untrustworthy. Size of plot is limited chiefly by the labour required to weigh the produce. Comparative experiments should be on plots of ½a. at least, so that soil variations and quality differences in the manures might be minimised. The kind of soil, so long as it is uniform, is unimportant, although obviously the results obtained will apply specifically to that type of soil. The condition of the soil is however important, and its past history, cropping, and manuring, must be noticed. Everything must be done by weight and measure, nothing guessed or estimated. The chemical composition and physical qualities or condition of all substances must be accurately ascertained and recorded. Two experiments of the same kind, one to check the other, should always be made. Johnston's specimen plot lay-out shows that he had elementary ideas of randomization, and he sees the necessity for recording observations during the growth of the crop, and also for meteorological records. Not least important, he is insistent that observations should be made and recorded by the chief experimenter himself, and that even he will be well advised to guard against the possible influence of preconceived opinions.

Finally the object of the work must be clearly defined before it is commenced. Experiment ought to have a definite object, to be designed to throw light on some special points, to remove some doubt, or to solve some recognized practical or theoretical difficulty; and always it must be comparative.

This definition is so practical and modern that it marks the beginning of modern scientific field experimental technique, and, at least in theory, the end of the vague, unsatisfactory and ill-defined experiment of early times.

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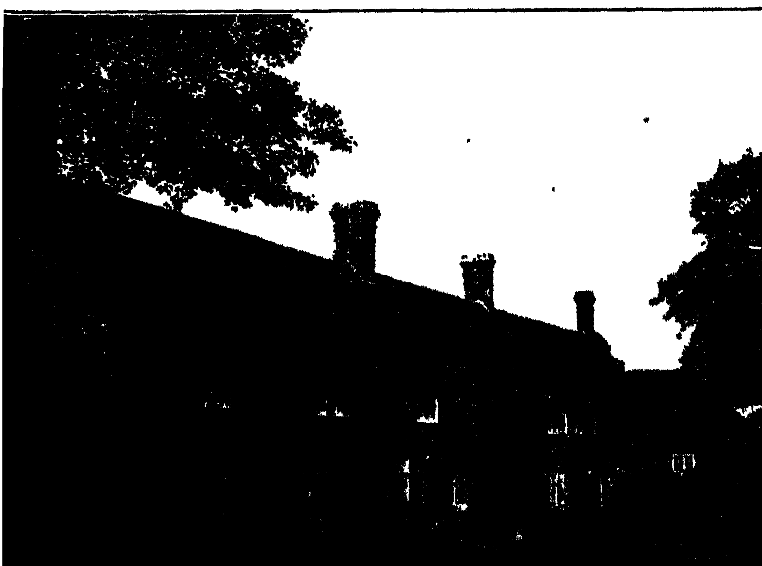
[A further article dealing with modern experimental technique will be published in the next volume of the Journal.—Ed.].

NOTABLE FARMING ENTERPRISES.—VI.

I.—The Fruit Farms of Spencer W. Mount, Patrixbourne, Canterbury.

Mr. Spencer Mount first began fruit farming in 1902 when he planted up some 40 acres at Barton Farm, near Canterbury. In 1907 he took Hode Farm, Patrixbourne, where he now lives, and on these two farms, comprising over 400 acres, he went on developing the fruit acreage until 1918. He then took over Milestone Farm, 91 acres, followed this up in 1922 with the purchase of Part Saint Lawrence Farm, 136 acres, and finally



Hode Farm, Patrixbourne, Canterbury, the home of Mr. Spencer Mount.

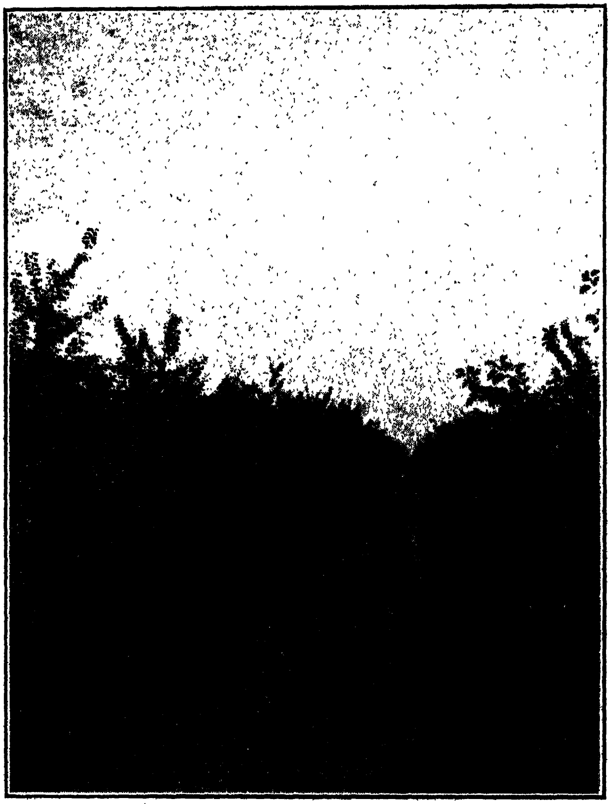
rounded off that property in 1925 by acquiring Little Barton Farm, 107 acres. This brought 980 acres of fruit, or land in preparation for fruit, under his direct control, and for the last ten years the work of developing this multi-farm unit and of bringing it into line with the most up-to-date systems of fruit-growing has kept Mr. Mount fully occupied. True to family tradition, however, his eldest son, Mr. James Mount, soon made it clear that he was determined to go in for fruitgrowing, and Mr. Mount at once began delegating to him a gradually increasing amount of responsibility and proceeded to look about for more

land on which to plant fruit for his younger son, Mr. David Mount. The land in the immediate vicinity of Canterbury was by this time pretty fully occupied by Mr. Mount and his three fruitgrowing brothers and their families, and the two farms of Wootton and Buckholt, each 220 acres, which were taken over in 1934, are situated at a distance of some 5 or 6 miles to the south-west of Canterbury, at Petham and Waltham respectively. On these two farms over 300 acres were planted up with fruit last year, so that Mr. Mount and his two sons now control between them seven farms totalling over 1,200 acres, nearly the whole of which is devoted to the culture of tree fruits.

A word or two should be said here as to the general system of planting which Mr. Mount has evolved in the light of his experience during the last thirty years. One of the main principles laid down by his father, the late Mr. George Mount, a pioneer of commercial fruitgrowing in the Canterbury district, was to aim at producing in bulk the best market varieties of apples and plums and always to keep right up to date with regard to methods of packing. Starting at Barton Farm in 1902, Mr. Spencer Mount adopted the methods prevailing at that time and planted apples and plums as bush and half-standard trees with currants and gooseberries between them and strawberries underneath. Some ten years later began the movement towards packing apples in non-returnable boxes, and Mr. Mount was one of the first to try out the new idea. The Kent Commercial Fruit Show (forerunner of the Imperial Show) was just being started in the county, and since Mr. George Mount had found it profitable, when growing rose trees in his nursery at Canterbury, to exhibit at every big Show in the country, it was not unnatural for his son to try out this method of bringing his apples to the notice of salesmen in the big London and provincial markets. How successful this policy proved is now a matter of history in the fruit world, his crowning achievement being at the Imperial Fruit Show at Holland Park in 1925, when he carried off ten first prizes, three seconds, one gold cup, nine silver cups and four gold medals.

Largely as the result of his early successes at commercial apple shows, Mr. Mount came to concentrate more and more on tree fruits to the gradual exclusion of the undercrop and later, as the difficulties of manuring, spraying and cultivating of apples, plums and pears together became more and more apparent, he adopted the policy of planting these three crops separately, with apples as the primary consideration. Thus in the most recent plantings of 1934 apples were planted in the proportion of six to one of pears or plums. Again, in the matter of distance of planting, the gradual rise to ascendancy of the apple as the main crop is reflected in the steady increase in the distances allowed

between the trees at time of planting, all making for increased speed and efficiency in cultivating and spraying. Whereas, in the early days at Barton Farm, apples and plums were planted 10 feet apart, the distance selected for the most recent plantings of bush trees of dessert apples on semi-dwarf stocks on land of medium strength was 15 feet apart all ways.



A Plantation of Bramley's Seedling Apples at Hode Farm, Patrixbourne.

Again, in the matter of cultivations it is interesting to trace in the history of Mr. Mount's farms the evolution of the modern idea that there can be no hard and fast rule, where fruit trees are concerned, as to the correct degree of cultivations to be carried out, and that "clean" cultivation, semi-cultivations, weeds and grass are merely so many "management factors" which in the hands of a skilful grower can be used to produce definite effects on tree growth and fruit quality, according to the requirements of each plantation. Before the War close planting and clean

cultivations were the tradition in Kent, the ground being dug over with a fork in the winter, levelled down with a Canterbury hoe in the spring, and hoed again with a Dutch or with a swan-neck hoe two or three times in the course of the summer. In 1914 war broke out and carried off most of the men who did all this digging and hoeing. Fortunately for Mr. Mount, he had already started the previous year a transition to tractor cultivation, so that he was able to adapt himself more quickly to the changed conditions. It was, however, one of the many ironies of the War that at a time when everyone would have liked to be free to grub their closely-planted bush fruits in order to facilitate a more economical system of cultivation, the demand for fruit of all kinds was so great that it became a matter of national importance for fruitgrowers to retain the very bushes which they would have liked to grub out. At the same time scarcity of labour made it difficult, or almost impossible, to keep hand cultivations going on anything like the scale that had obtained in the days of peace, so that there was a very general tendency before the end of the War for plantations to go down, either partially or completely, to grass or weeds.

Naturally this state of affairs led to a general exhaustion of the supplies of plant foods in the soil, so that when the movement began towards the introduction of pigs into the orchards and plantations Mr. Mount went in for pigs and gave them a thorough trial in his plantations from 1919 to 1925. Their function was to be two-fold; they were to bring the land back into cultivation and at the same time to renew the depleted supplies of nitrogen and other plant foods. The pigs proved to be enthusiastic if unequal cultivators, and did a good deal of harm to apple trees by gnawing the bark of the stem and the lower branches of bush trees. From the manurial point of view, so long as they were not allowed to root too deeply they did a great deal of good in the case of nitrogen-loving fruits such as plums and damsons. In apple plantations, however, the large amounts of nitrogen present in pig manure, in comparison with its potash content, and the unequal method of its distribution, did much to upset any balance that already existed between these two elements. It was just about this time that Dr. Wallace was completing the important series of experiments in manuring which was to bring out so forcibly this very point about potash-nitrogen ratio, and Mr. Mount was one of the first to realize its implications. Pigs were banished from his plantations, bush fruits were grubbed, and for the last ten years the manurial programme for apples has been directed towards building up and maintaining a basic supply of available potassium in the soil, and of superimposing upon this dressings of nitrogen in accordance with the requirements of the trees.

At the same time the whole policy with regard to cultivations was gradually brought into line with the changed circumstances. Whereas before the War all the fruit crops in any one field had to be treated alike, both from the cropping and the manurial point of view, to-day each crop is being planted separately and can thus be given whatever special treatment it may require without interfering with other crops.

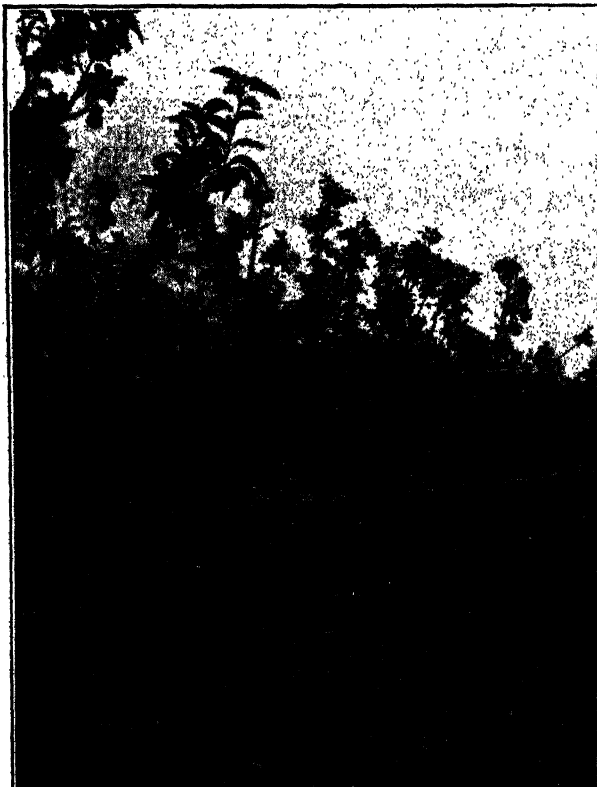
On Mr. Mount's farms at the present time there are young plantations of apples and of plums where the tractors are cultivating all ways throughout the season in order to encourage growth, and there is not a weed to be seen. In other older plantations the tractors are kept going till about the end of June, after which the weeds are allowed to grow in order to check excessive growth. In yet a third series of established plantations the natural herbage has been allowed to grow, and by dint of regular cutting with triple mowing machines the sward now presents the smooth appearance of a golf course. Such an elastic system of culture is rendered all the more important by the extreme variability of the soils in the area covered by Mr. Mount's farms. A strong loam that will grow stout young trees when well cultivated may later produce such excessive growth that the trees will have to be grassed down quickly. Or again, a sandy or gravelly subsoil such as is to be found on one farm where Mr. Mount grows some of his most famous Worcesters may give beautifully coloured apples when under grass but, if a series of droughts should come along, it may be essential to break up the turf in order to start the trees growing again.

The illustrations given above will serve to show how, on these farms, cultivations and manuring are now used as tactical weapons in the hands of the grower to supplement each other in controlling the activities of the trees.

On Mr. Mount's farms the kinds and varieties of fruits grown are limited to those which have proved to be the most suitable from the joint aspects of growth, cropping and marketing, and are discarded or worked over to other sorts as and when they cease to be profitable. At the present time Bramley's Seedling and Worcester Pearmain are the most widely grown apple varieties, but in recent years an increasing number of trees of other varieties, notably Lane's Prince Albert and Early Victoria, have been top-grafted to Cox's Orange Pippin and quite a large acreage of this variety has lately been planted, along with a suitable pollinator, as bush trees on semi-dwarfing stocks.

No description of Mr. Mount's farming enterprises would be complete without some reference to his astonishing feats in the transplanting of established trees from overcrowded plantations to make new plantations of fruiting trees on another farm. Others may have done this successfully on a comparatively small

scale, but it was left to Mr. Mount to demonstrate the practicability of the undertaking on a commercial basis. The trees, which consisted for the most part of Bramley's Seedling and Worcester Pearmain of sixteen years or more, were moved bodily without any drastic branch pruning, as much as possible of the root system being retained, and were carried in lorries to their new position, where they were planted in broad shallow holes and supported firmly against winter gales by being tied to a single



A tree of Worcester Pearmain moved bodily at twenty years of age from a considerable distance three years ago.

stout chestnut pole driven in at an oblique angle, heading towards the prevailing wind.

Within four years these trees were again cropping freely and in one case they grew so strongly after this period that it was necessary to resort to grassing down in order to check their growth and keep them from becoming overcrowded.

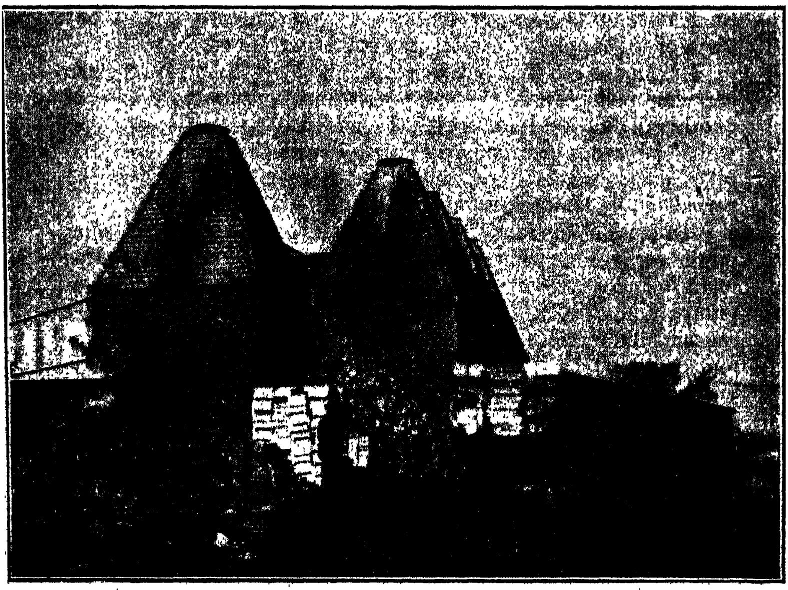
In the matter of pruning, Mr. Mount's chief aim with all his tree fruits has been to secure, for each branch of every tree, the greatest possible share of air and light without too much forcing of lateral growth by spur-pruning. The policy with Bramley and Worcester in particular has been one of regulated pruning rather than of systematic tipping and spurring, a policy which is admirably adapted to the growth habits of these two varieties. No summer pruning is practised and fruit thinning is carried out only on certain varieties of apple (such as Early Victoria and Miller's Seedling) which are known to set their fruit in clusters and to produce small fruits unless heavily thinned. Mr. Mount does not advocate the regular thinning of Bramley's Seedling, for he finds that he can get the best commercial size for his box pack of this apple by leaving the fruits unthinned.

Mr. Mount is a firm believer in the help given by hive bees in carrying pollen from the flowers of one variety to those of another in all kinds of fruit. In addition to the sixty hives which he keeps permanently in his plantations he hires 100 hives every year to be brought into the plantations for the period of the fruit blossoming season.

In spite of his fondness for bees, Mr. Mount has been using power spraying machinery ever since 1910. His present equipment includes two large central spraying plants, with four throw pumps and Ruston Hornsby diesel engines. Permanent mains are laid underground and each plant will, when desired, take fourteen double nozzles at a pressure of over 400 lb. per square inch. In addition to these are four portable machines, with steel portable mains and rubber leads, for those parts of the farms which are not served by the central plants. As more fruit comes into the range of routine spraying additional equipment is acquired, Mr. Mount insisting that a grower should be able to spray through the whole of his fruit once in the course of a single week.

The possibility of protecting fruit trees from frost damage has always been a subject of interest to Mr. Mount, who was one of the first fruitgrowers in this country to try out, many years ago, the American system of "smudge pots." This year Mr. Mount made an extensive trial over an area of about 60 acres in the use of the Harrington Orchard Heater, supplied by Messrs. George Monro Ltd. During the critical late frost period two men were kept on night watch in the plantations, and early in the morning of May 17th they raised the alarm and some 4,000 heaters, burning crude oil, were lit up. In this area, where some established apple and plum trees were growing in a hollow, an excellent crop of fruit is now to be seen, although eight degrees of frost were registered at a height of 3 feet from the ground outside the heated area.

On Mr. Mount's farms special attention is paid to the method of fruit picking. This operation is carried out by piecework, under very careful supervision, and Mr. Mount finds that he very seldom has to change his pickers once they have been trained. Apples are packed into shallow wooden trays which are then stacked on carts or lorries and taken to a central packhouse consisting of a corrugated iron building, 120 × 40 feet, with good north lighting and plenty of headroom for lorries to enter and leave with full loads. Three full-sized Cutler graders are used for sizing and sorting the apple crop which, according to variety and grade, is then packed into baskets, trays or boxes.



Hop Oast House converted into a Cold Store for Apples at Barton Farm, Canterbury.

Mr. Mount was one of the first growers in this country to experiment with new methods of storage, a cold store having been installed on his farm in 1913, and a carbon-dioxide gas-store chamber in 1929. Since then a large new gas store, with a capacity of 40,000 bushels, has been erected next the packhouse. This store is specially constructed to allow of rapid loading, a factor which Mr. Mount believes to be essential to success in this method of storage. Lorries are loaded in the packhouse with double layer trays containing apples which have been carefully graded for soundness and freedom from blemish, and folded in oiled wrapping papers. The lorries drive right into the gas store

building at one of two doors at front and back, unload from either side into one of the eighteen separate gas chambers, and drive out empty at the other end. In this way the whole store can be loaded and shut down for the winter in the course of a fortnight.

Mr. Mount has made a special study of the art of packing fruit, especially in non-returnable packages, and there is no

Packing Plums into non-returnable 14 lb. wooden boxes.

doubt that the rapid progress in box-packing which has been made in this country since the War is due in no small measure to his example and to the high standard which he has always rigidly enforced in his own packhouse. For many years every exhibit of the hundreds which went up to the Imperial Fruit Show from Mr. Mount's farms was packed under his critical eye, and many by his own hands.

Until a comparatively short time ago all fruit was sent up to London and the more distant markets by train, but for various reasons road transport is now found to be more economical, and nearly everything now goes to the London market by hired lorry.

On Mr. Mount's farms the regular establishment of employees numbers about 100 men and thirty women, and in addition between 200 and 300 persons, mostly women, are given temporary employment at different times of the year in picking,

Mr. Spencer Mount in consultation with a member of his staff in the new packing shed. Note the 14 lb. non-returnable box package for plums stacked in readiness for transport to market.

packing and other seasonal operations. In order to accommodate these workers a large rest and recreation room is shortly to be erected beside the central packhouse and stores.

Mention has been made of Mr. Mount's policy, originated in the first place by his father, of attaching superlative importance

to the presentation and marketing of his fruit. This year the whole of the Mount family, living in and around Canterbury, have combined for the purpose of marketing their high-grade fruit. Trading as Mount, Canterbury, under a group brand, they have established their offices at Little Barton, a beautiful old farmhouse built in 1637 and bearing its date proudly in figures of iron on its gables. Here in a board room that was once a granary, but which is now equipped with all the amenities of a London office, fifteen worthy descendants of Mr. George Mount meet periodically to transact their business under the chairmanship of Mr. Spencer Mount. Each of the four members of the family firm contributes his choicest fruits to this marketing scheme, which in return provides for each member the economies and conveniences of centralized trading on a very large scale. The fruit is marketed under the group brand which can, when thought desirable, be used in conjunction with the National Mark. Consignments are sent regularly to leading salesmen in London and to twenty of the principal markets in the provinces, and by an ingenious system of book-keeping an exact record is kept throughout the season showing the day-to-day prices received in each market and from each salesman.

In spite of all his farming and business activities, Mr. Spencer Mount has found time to keep in close touch with all that is going on in the field of research. For many years he has been a member of the Agricultural Research Council, and East Malling Research Station owes him a great debt of gratitude for several years of devoted service as Chairman of their Finance Committee.

To sum up, the main points of interest to the fruitgrower arising from this account of Mr. Spencer Mount's farms are in connection with his pioneer enterprises in the growing and marketing and storing of fruit during the last thirty years. These enterprises include his early experiences with tractor cultivating, wide-distance planting, crop specialization, the adaptation of cultivations, manuring and pruning methods to the production of high-grade fruit, power spraying, box-packing, commercial fruit show exhibiting, cold and gas storage, and group marketing.

The main points which he stresses in regard to the planting up of fruit, as a result of his own experience, are the importance of limiting varieties to the smallest possible number, consistent with market requirements, and of maintaining the right balance between varieties when planting so as to ensure that, with the picking labour available, fruits of short season can be got off the trees and away to market in good time, and long-keeping fruits may be harvested and stored with the utmost despatch once picking has started.

Finally, before selecting a market, Mr. Mount believes that a wise grower will make certain that he can keep that market

continuously supplied with some particular line of fruit throughout the season, for only thus does he consider it possible to command the very best service from that market. Growers of limited areas who ponder over this recommendation can hardly fail to see the implication underlying it, for in order to keep a market continuously supplied in this way a small grower must surely belong to a marketing group.

N. B. BAGENAL.

East Malling Research Station,
East Malling, Kent.

II.—AN UP-TO-DATE FARMING AND HORTICULTURAL ENTERPRISE.

THE great development of commercial horticulture which has taken place during the past five years is well known. The opportunity afforded by the reduction of certain classes of imports, brought about by tariffs, has been eagerly seized on by market gardeners, and many farmers have taken up the growing of market-garden crops on a large scale.

The Holland Division of Lincolnshire has been long noted for its intensive cultivation, and for the growing of certain classes of market produce on an extensive scale. It is not surprising, therefore, to find in that district one of the most up-to-date of market-gardening enterprises, combined with what may be regarded as intensive agriculture.

The owner of the business to be described is Mr. Cecil Robinson, a man greatly alive to the possibilities of new developments, and keenly interested in the development of the horticultural industry of this country. The great success which Mr. Robinson has achieved is due to business ability, capacity for organization, and a detailed knowledge of the cultivation of the various crops. His success on the latter side is due partly to his careful selection of men possessing the necessary knowledge, or men who can be trained to the work.

General Survey.

The total area is approximately 700 acres—not all in one block, but divided into several farms. While this acreage might not be regarded as large for a grass or corn-growing farm, some idea of the intensive nature of the concern may be conveyed when it is said that the value of the land is, on the average, over £80 per acre (apart from other capital outlay such as glasshouses) and that the wage-bill amounts to more than £20 per acre per annum.

The enterprise is divided into various sections, with a responsible manager in charge of each; or, in some instances, a manager

in control of two sections, with two foremen under him. Thus each manager is able to specialize in his own particular branch, and is responsible directly to the head of the concern.

The sections into which the enterprise is divided are :—(1) General farming, including seed-potato growing ; (2) large-scale market crops on the farms, including fruit, flowers and bulbs (and including also the glasshouses when used for forcing flowers) ; (3) tomatoes and cucumbers (including the growing of plants under glass required for the outdoor early-produce department) and Dutch lights.

The Soil.

The greater part of the land consists of rich alluvial deposit in a high condition of fertility. Some forty years ago a considerable acreage was old-established pasture. As in other parts of South Lincolnshire, the value of these pastures for potato-growing was recognized, and they have mostly now been brought under the plough.

In parts, the soil is of a heavier nature. This land, however, is used for crops requiring such a soil, as for instance, certain varieties of potatoes and some brassica crops.

The soil surrounding the central buildings, etc., is of an exceptionally fertile nature, and it is on this that the Glasshouse and Dutch Lights Departments have been developed.

The fertility of the soil is maintained to some extent by the type of rotation adopted, partly by the fattening of about 150 cattle, chiefly in yards during the winter, and partly by the manure from a considerable number of pigs. Large quantities of artificial manure are used. The character of the soil is such that fertility can be maintained for a number of years by artificials alone. It is realized that the problem of maintaining fertility may become of greater importance, but the situation would soon be relieved if bullock fattening were again to become a paying proposition.

The General Cropping.

What may be termed the farm cropping is centred largely round the potato crop. At one time over 200 acres of potatoes were grown, but owing to the increase in the acreage of market-garden crops, this has now been reduced to 150 acres. Of these, 20 acres are early varieties for lifting in June and early July, the crop being immediately disposed of as ware. The remaining 130 acres are grown for seed. This acreage is planted every year with Scotch seed, the produce of which is, of course, disposed of as "once grown" seed.

Potatoes are, as far as possible, grown after a clover crop, the aftermath of which is ploughed in as green manure during

July. The clover is sown in a cover crop of cereals, chiefly wheat. Only a small acreage of oats is grown, sufficient for the requirements of the farms. Neither barley nor field beans finds a place.

The land for potatoes, as indeed for most crops other than cereals, is ploughed 8 inches deep and subsoiled to a further depth of 10 or 12 inches. Where possible the ploughing and subsoiling are done by cable tackle (steam at present). The smaller fields, where such tackle cannot be used, are ploughed and subsoiled by tractor, a combined one-furrow plough and subsoiler being employed.

All seed potatoes are sprouted under glass, and the crop receives a dressing of 15 cwt. per acre of a well-balanced artificial compound suitable to the soil. Sulphate of potash is the only source of potash used, either for potatoes or other crops.

Market-Garden Crops (Large scale).

Of the market-garden crops cultivated on a large scale, the chief are cauliflowers and broccoli, of which over 80 acres are grown annually. The cauliflowers for the first and second crops are grown under glass, and are ready for cutting in the end of May and beginning of June. Further details will be given later. By a careful selection of varieties it has been found possible to make the cutting of cauliflower and broccoli continuous throughout the year; indeed, since January, 1933, no single week has passed when one or the other has not been marketed. It may be remarked that broccoli are regarded as being winter hardy, whereas cauliflower are not. Not all varieties of broccoli, however, are hardy in the colder climate of eastern England. This statement applies, for instance, to the Roscoff types now so largely grown in the south-west of England, and marketed in February and March. Broccoli are usually sown out-of-doors in April or early May and are planted out in their permanent quarters in June or July. Mr. Robinson's method, which is unusual but has so far proved very satisfactory, is to grow most of his broccoli after clover. As is the case when potatoes are to follow clover, the aftermath is ploughed under early in July. Before ploughing, all land to be planted with broccoli receives a moderate dressing of farmyard manure. This is applied to the aftermath and is ploughed in with it.

All land from which bulbs (daffodils, tulips, etc.) have been lifted is at once ploughed over and planted with broccoli or other brassica crops.

Another market crop produced on a considerable scale is Peas. These are all grown for the market, none being sold for canning or allowed to mature. A succession of varieties provides for pulling from mid-June to August, the varieties at present

grown being Early Bird, Meteor, Thomas Laxton, Onward and Standard. The land that has been used for peas is ploughed as soon as the crop is cleared, the pea straw being turned under as manure. The greater part of the area is then planted with bulbs, chiefly daffodils. The planting of these goes on from August to November.

Garden beans are also grown, but only for the very early market, the variety used being "Seville." The seed is sown in early October, and pulling commonly begins about the 10th June. As in the case of peas, the straw is ploughed in, and the land either cropped again immediately or else later planted with bulbs.

A considerable acreage of spring cabbage is planted in October and, so far as possible, the crop is cleared as "greens" in early spring, to allow of a following crop being planted in time. Something of a speciality is made of the production of cabbage for the July and August market, a season when cabbage is sometimes none too plentiful. The seed for this crop is sown under glass—in Dutch lights—in early spring, the young seedlings being later pricked out, and finally transplanted in their permanent quarters.

Brussels sprouts are treated in a similar manner, and are then usually ready for picking in September. Another crop receiving this treatment is leeks, which are planted out-of-doors in mid-May, and are ready for lifting early in September.

Mention must be made of out-door lettuce. The acreage of this is naturally limited, but is considerable for the kind of crop. Sowings are made out-of-doors, so that supplies are ready when the frame-cultivated lettuce is finished. These supply the market until the end of June, when lettuces usually become a glut in the market. Further sowings are, however, made in late summer to supply the market in autumn, when salad crops again become scarcer and realize better prices.

Every outdoor garden crop receives a heavy dressing of a mixture of artificial manures considered suitable for its particular needs.

Fruit (Out-door).

Fruit does not at present constitute a very important department, but does receive some attention. Thirty acres of strawberries, ten acres of gooseberries and fourteen acres of raspberries are grown, most attention being paid to the strawberry crop. A small acreage of the cultivated blackberry has been established and, having proved successful, is now to be extended. Top fruits (apples, etc.) are not now grown, apples particularly having proved an unprofitable crop in the whole of the district for the last fifteen years, chiefly owing to poor yields. Mr. Robinson preferred to cut his losses rather than persevere

with an unprofitable and unpromising enterprise, especially since the land could obviously be put to better use.

Intensive Market Gardening.

The most interesting of the departments is that devoted to the production of early crops under glass, or under a combination of glass and out-door culture.

The area covered by the existing glasshouses is four acres, and a further acre of glass is at present in course of erection. Eight thousand Dutch lights (frames) are also in constant use, bəing moved from crop to crop as and when required.

The glasshouses are used for the forcing of flowers (chiefly daffodils and tulips), for tomatoes, cucumbers and melons, for the growing-on of cauliflowers during the winter months, and, of course, for the raising of tomato, cucumber and melon plants. Mr. Robinson's object is to have both his glasshouses and his frames always turning out a marketable crop, as many as three or four crops being obtained, in some cases, in the course of a year.

Flower Culture.

The first crop obtained from all glasshouses (except those used for propagating, etc. and for cauliflowers) is one of daffodil and tulip flowers. As far as possible the bulbs required for forcing are grown on the farms. The stocks for the production of forcing bulbs are planted in the fields on suitable land in the autumn, and are lifted again in the following June or July. After cleaning and grading, suitable sizes for forcing are selected, the largest being sold to the retail trade and the remainder set aside to plant for future supplies and for out-door flowers.

The bulbs for forcing are planted in boxes, the operation beginning in August with daffodils and continuing with tulips. Particular attention is paid to the modern methods of preparing bulbs for very early flowering by their special treatment during the storage period. By this means suitable varieties can be forced into flower by Christmas week. From this date cutting goes on continuously—first from the houses, then from the Dutch lights, and lastly, until about the beginning of June, from out-doors.

After boxing, the bulbs are covered with straw and are left out-of-doors until November, when they are placed in the glasshouses. All the houses (with the exception of that used for cauliflowers, etc.) are thus filled, so that one crop of flowers is first obtained. The flowers in the earliest houses are all cut by mid-January. The boxes are then removed, the soil in the house made ready, and early tomatoes are planted. The tomatoes in these early houses are ready for gathering by the end of April,

from which time continuous supplies are produced until the end of the season in October.

Tomatoes.

The remainder of the houses, as the first round of flowers is finished, are again filled with bulbs. When the earliest of these are again emptied, second-early tomatoes are planted. The later houses are again filled with bulbs, and subsequently planted with tomatoes, so that some of the houses produce one crop, some two crops, and the remainder three crops of flowers, followed in each case by tomatoes.

The soil is eminently suited to tomatoes, and as ample supplies of such soil are available in the fields adjoining, the soil in the house is changed every third year. Thus the expensive method of soil treatment, necessary in other districts, can be dispensed with. The soil used for the seedling tomatoes, is, however, sterilized.

The leading shoots of the tomato plants are not removed when the plants have reached a certain height, as is usually done, but are trained over horizontally and allowed to continue their growth until all the fruit has been gathered. By this method a much heavier crop is obtained.

Tomatoes are also grown under the Dutch lights used for protecting and forcing tulips planted in the open ground, the tomatoes being planted as soon as the flowers have been cut.

Cucumbers.

A number of smaller houses are devoted to the cultivation of cucumbers, some houses producing three crops per year. One or two of these houses grow a crop of early marrows, and are afterwards planted with cucumbers.

Dutch Lights.

Cultivation under Dutch lights is a special feature of the enterprise, Mr. Robinson being one of the pioneers of this method of producing early crops. So important is the department that it is placed under separate control, the person in charge being responsible for this section alone.

Several systems of rotation or cropping are adopted. The principal crops grown are lettuce, carrots, radishes, turnips, tulips, melons and vegetable marrows.

The majority of the lights are planted out with lettuces in November, the seed having been sown in early October. The young lettuce plants are set out 8 inches apart, *i.e.*, forty per light. At the same time as the lettuce seed is sown about 100 lights are sown with radishes and carrots. In November, lettuce plants are set out in these lights and are ready for cutting in March. In the meantime the young carrots and radishes have been

developing, and take the place of lettuces when the latter are removed.

Another section of the lights is planted with lettuce in November, and in January gladioli corms are inserted 4 inches apart. The gladioli are well through in March, when the lettuces are cut, and very soon reach the glass. As growth progresses the glass is gradually raised, and may ultimately, if necessary, be removed altogether. When possible, however, the glass is left over the gladioli plants in order to protect the flowers from rain, etc. By this method two crops are obtained from these lights, and the gladioli flowers are ready for market some very considerable time in advance of the out-door crop.

In still another series of lights, the first crop of lettuce is followed by marrows, the young plants being raised in the propagating houses and brought on so as to be ready for planting in the frames in April. Marrows can then be cut for market at a season of the year when good prices are likely to be realized.

The same system is also adopted for melons, of which large quantities are grown, but in this case part of the late melon crop may be grown in frames which have already produced two crops of lettuce or which may have grown young cauliflower plants, followed by lettuce.

Mention has already been made of early cauliflower, which is a special feature. The trade in this has, in the past, been almost entirely in the hands of the Dutch and Belgians. Those who have visited the famous Malines cauliflower market have no doubt been amazed at the enormous quantities of early cauliflower offered for sale during the period from the last week in May till late June, a period of the year when cauliflowers are, of course, particularly scarce, even in up-to-date private gardens. A very considerable amount of the Dutch and Belgian produce used to find (and in spite of tariffs still finds) its way into the English market. The value of travel is often emphasized from a health point of view, but it can also be of value from other standpoints, and Mr. Robinson admits that he first realized the possibilities of the growing of early cauliflowers and early salads through his travels abroad, and by using his powers of observation.

The cauliflower seed is sown under Dutch lights in late September or early October. When the plants are large enough to handle, a portion of the young seedlings are transferred to other lights, being set out 3 inches by 2 inches apart. About 100,000 are also planted out in small "60" size pots and are kept in a cool house over the winter. These latter plants make more growth than those in frames—they suffer no check when put out in their permanent quarters and are ready for cutting in advance of those wintered in the frames. Both lots are planted out-of-doors on friable soil, in good heart, about the

end of March. As previously stated, the lights are filled with lettuce plants as soon as the cauliflowers have been removed.

Reference has also been made to the use of Dutch lights for the protection of early-flowering tulips. For this purpose tulip bulbs of flowering size are planted out in beds to correspond with the length of the Dutch lights. During the winter a simple framework is erected round each bed, of an average height of about 3 feet—lower in front to give a slope to the lights. The length of the beds may vary according to circumstances and may take any number of lights. In February the lights are placed on the framework, and canvas about 2 feet wide is run round from the ground level to give extra protection. Thus tulips may be induced to flower a month before the same variety would be ready in the open field. Not only so, but the flowers are of excellent quality, being free from the blemishes so often caused to out-door tulips by rain, hail or wind.

As previously stated the beds, when the tulip flowers have been cut, are at once planted with tomatoes. The crop on these is limited to three trusses, which is not only all that can be obtained without raising the lights, but all that will ordinarily ripen under such conditions.

As has also been said, some of the Dutch lights are used for raising seedlings of brussels sprouts and leeks. The seed is sown in March and transferred to the open in May.

Marketing.

Mr. Robinson lays great stress on the importance of marketing his produce in the best possible way. All the market produce sold off the farm is graded and packed according to National Mark standards, where such have been defined and are in operation. Otherwise Mr. Robinson grades to what would be comparable standards. In conjunction with the National Mark labels, Mr. Robinson also uses his own registered trade mark.

All the produce is brought to a central packing station, where there is a special staff for grading and packing.

Except for flowers, non-returnable packages are used, the expenditure on these packages being over £1,000 per annum. The packages are purchased in sections and are put together on the premises, modern machinery being used for nailing, etc.

Non-returnable packages were at one time used for flowers, but these proved too expensive, and returnables are now employed. Other flower growers in the district have had the same experience and have reverted to returnable packages.

Heating of Glasshouses.

When the houses were first erected coal was used for the boilers, but with the advent of a satisfactory system of oil-heating a change-over was made. This was found very suitable,

as the thermostatic control enabled a more uniform temperature to be maintained, especially at night. The imposition of a duty on oil, however (amounting to £504 on an oil bill of £2,520) rendered the method too expensive, and a return to solid fuel had to be made.

Small coal is now used and mechanical feeders are employed. Fortunately it has been found possible to obtain thermostatic control of the mechanical feeders, and the method is now regarded as entirely satisfactory. Over 2,000 tons of small coal are used per annum.

Labour.

It will be realized that the enterprise of necessity employs a large amount of labour. Reference has already been made to the organization into various departments, and this system is maintained as far as possible with all labour. Thus the employees get expert in their own particular spheres, although, of course, some interchange is necessary at certain times of the year.

Much of the work is specially suited to women and girls, of whom large numbers are employed. All the labour is obtained from the surrounding villages. The numbers are fairly constant throughout the year and, as far as possible, piece-work is engaged in. The wages bill averages £16,000 per annum.

Conclusion.

It will be realized that the success of the enterprise described depends to a large extent upon efficient organization. In each department the amount of detail requiring attention is enormous, and this must of necessity be left to the responsible managers. Thus the selection of these men is important.

Since all the produce is graded an incentive is provided to produce crops of high standard, the grading of the produce bringing to notice the standard of quality attained with each crop. Further, as most of these crops are expensive to grow, it is essential that the best possible prices be realized for them, and this can be done only by a high standard of grading and packing. Mr. Robinson lays as much stress upon the marketing of the produce as upon the growing of it.

Finally reference must be made to the economic value of such an enterprise to the locality, and to the national gain which would result from the further development of the market-garden industry. That there is room for further development is clear from a study of the volume of our imports.

J. C. WALLACE.

The Agricultural Institute,
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THE DEVELOPMENT OF AGRICULTURAL EDUCATION IN YORKSHIRE.

The scheme of agricultural education, as it exists in Yorkshire to-day, may be said to have started in 1890 when the Department of Agriculture of the Yorkshire College of Science was established. A good deal of educational work had been done in earlier years, particularly through the activities of agricultural clubs and of the Yorkshire Central Agricultural Association, which was founded at York in 1832. It is true that these organizations were formed, in the first instance at any rate, to promote legislation in the interests of farming, but it was inevitable that they should have led to some sort of educational work. The coming of legislation concerning fertilizers and feeding stuffs, for instance, inevitably created a demand for information on the composition and use of these articles.

Also, in 1837, the Yorkshire Agricultural Society was formed, and it has, ever since, exercised a considerable influence upon the development of agricultural education in the county.

It must be recognized, too, that since the establishment of the scientific basis of crop husbandry there have always been individual teachers and educationalists, as well as some local authorities, who have inspired and encouraged the study of the science of agriculture in their own localities. No account can be given of such work, but tribute must be paid to it in these introductory remarks.

The Yorkshire College and Agriculture.

"The Yorkshire College of Science" was established in Leeds in 1874. Its function was to develop and teach the sciences pertaining to Yorkshire industries, and a wider conception of its functions—a conception leading ultimately to the University of Leeds—is indicated in the change of its name to "The Yorkshire College" in 1877. The College was an established part of the Victoria University, which also included the colleges at Liverpool and Manchester. It became autonomous, as the University of Leeds, under Royal Charter in 1904.

There was no Department of Agriculture at the beginning, but it was definitely intended that one should be created as soon as the opportunity arose. In 1890, by a combination of two circumstances, the opportunity did arise, and it was grasped in a very statesmanlike way. One circumstance was the establishment in 1889 of the Board of Agriculture as a State department, and the other was the Local Taxation (Customs and Excise) Act of 1890, which provided County Councils with funds for technical, including agricultural, education.

A deputation representing the interests of the College and of Yorkshire agriculture went to the Board and received from Mr. Chaplin, the then President, sufficient encouragement to lead to a conference at Harrogate, and the formation of a committee to prepare a scheme for establishing a Department of Agriculture. The Committee, which included a number of eminent landowners and agriculturists, met under the chairmanship of Lord Herries and worked very intensively. A scheme was prepared in which funds were drawn from three main sources. A private subscription list yielded between £450 and £500; the three County Councils of the Yorkshire Ridings, with the new financial resources at their disposal for agricultural education, agreed to entrust the county work of agricultural education to the College, each county paying to the College a sum of the order of £1,000 a year; and the Board of Agriculture agreed to supplement the funds obtained locally. This fusion, into one organization, of the College and county work was the foundation of the present scheme of agricultural education in Yorkshire, which still remains quite unique.

The proposals received some measure of criticism and doubts were expressed in the press and elsewhere both about the value of such a Department to the Yorkshire farmers, and the possibility of getting students in appreciable numbers. But Lord Herries and his committee were not deterred, and the work began.

James Muir, who had been at the Royal Agricultural College, Cirencester, was appointed Professor of Agriculture, and he soon had seven colleagues—two lecturers in agriculture (these two lectureships were held for a long period by Mr. R. W. Haydon and Mr. C. F. Archibald), a lecturer in agricultural chemistry and botany, a lecturer in veterinary science and three instructresses in dairying. Apart from this staff for the new department, additions were made to the staffs of the existing departments of biology and geology in order to meet the requirements of agricultural students for instruction in these subjects.

1890-1897.

In the scheme of government of the Yorkshire College there was a committee for each of its technological departments, and such a committee was established for the management of the new Department of Agriculture. Lord Herries, who had presided over the committee responsible for the initiation of the Department, was its chairman from the beginning until 1897, when, as will be explained later, it was replaced by another body.

There were, in the first instance, two college courses—one extending over two years and the other over one year. In the first session there were only three students in the Department,

but this was not accepted as any vindication of the pessimists. In the second session the number had risen to eight, and in 1897 there were thirty-three students in attendance.

After the first year the Department arranged an agricultural course for teachers. This comprised Saturday classes at various centres in the county during two successive winters, with a three-weeks' summer vacation course in the College. It seems very unfortunate that, while these classes appear to have been well attended just at first, they had by 1895 failed altogether, "in spite of every effort to obtain sufficient numbers." The valuable results to be expected from classes in agriculture for teachers have been contemplated by more than one agricultural educationalist, and the possibility of reviving this early effort, with a more successful issue, should still be kept in mind.

In 1894, when the Department was four years old, the Board of Agriculture arranged with the College to conduct a course for teachers of dairying. Twenty-eight such teachers from all parts of the country attended a three-weeks' course, the curriculum of which included Dairy Farming, Chemistry, Botany, and Poultry-keeping. The success of this course was reported in the relevant annual report with some enthusiasm.

The College work in this period (1890-1897) progressed steadily from its very small beginning and was, except for the failure of the teachers' class, and considering all the difficulties, very successful. The county work had a less gradual development. The prejudices against it at the outset seem soon to have been dispelled and in a very short time large classes were being held all over the county. The staff was increased by the appointment of Mr. Thomas Redington to give instruction in Horticulture, and of Mr. Edward (now Sir Edward) Brown and Mr. Parton to deal with Poultry-keeping. In a very few years there were large classes in Agriculture, Horticulture, Veterinary Science and Poultry Husbandry, in addition to the Dairying classes that the three instructresses had been taking from the beginning. In the first annual report of the Department we read that "the unsympathetic attitude which the farmers at some of the centres assumed at first with respect to these lectures was often speedily changed to warm appreciation, which rose, in certain cases, to enthusiasm." The number of courses, apart from those in Dairying, was forty-three in 1891-92, and had risen to eighty-nine, with an average attendance of forty-nine, in 1895-96. In a few of the classes the attendance rose well into three figures, and an attendance of thirty or less at a few centres was generally regarded as rather low and unsatisfactory. It should be noted that there was a *course* of lectures—generally ten—at each centre, and that examinations were held at the conclusion of a course.

The Victoria University, of which, as has been said, the College

was a constituent part, had a system of travelling libraries in connection with its extension work, and in 1892 it was found possible to establish seven agricultural libraries which travelled the county in connection with the agricultural classes.

Demonstration plots in the county began in 1892. The West Riding County Council granted a sum, which was not to exceed £100, to the Selby Agricultural Club to enable it to carry out experiments on the cultivation of turnips and potatoes, and the College Department of Agriculture was asked to co-operate. It was not long before the Department was concerned with many such experiments in the county.

In 1896 there was formulated, at the request of the West Riding County Council, a scheme for the institution of gardens for instruction in Horticulture, which instruction was provided in connection with Evening Continuation Schools. At the outset gardens were started at seven centres and the scheme was very successful. There was a good deal of public interest in the work, shown, for example, by the raising of prize funds by local subscriptions at many centres. This work gave a considerable impetus to the development of allotments.

Garforth.

There were several notable changes and developments in the year 1897-98.

Professor Muir resigned in this year, and the Lecturer in Chemistry and Botany was appointed to the Chair of Agriculture. He left, however, after only a few months and was succeeded by Professor J. R. Campbell, who remained in charge of the Department until 1900, when he went to the Board of Agriculture and Technical Instruction for Ireland. He was succeeded in turn by Professor R. S. Seton, who remained in office until his retirement in 1932.

The great event of the year 1897-98 was the leasing by the East and West Riding County Councils of the Manor Farm, about one mile from Garforth village and about nine miles from Leeds. It can easily be understood that the need of a farm, to which the college lecturers could take students for instruction and demonstration and on which experimental work could be conducted, had long been felt. The North Riding County Council was not able at the time to participate in the farm scheme, and the Manor Farm was leased by the other two County Councils for thirty years at a rent of 30*s.* per acre, its management and use being entrusted to a "Joint Agricultural Council" made up of representatives of each County Council. The farm extended to 295 acres, about half being arable.

This step raised two important questions. First, the educational question—would it be better, with the acquisition of the

farm, to transfer the whole of the Agricultural Department of the College to the farm? And, second, since the farm was the property of the County Councils and not of the College, how would the agricultural educational work as a whole be best controlled?

The first problem of the advisability of moving the whole Department to the farm came up again, as will be seen later, just after the European War, when a new building for the Department—by this time a University Department—was about to be erected. On both occasions it was decided to leave the departmental buildings in Leeds, in the precincts of the College or University buildings, and it is hoped that the wisdom of this decision is not now questioned. A University Department of Agriculture, or any other University Department, should keep its staff in, and introduce its students to, the whole realm of education and learning. The course of subsequent events would necessarily have been different if the staff of the Department had been organically or even geographically cut off from the resources of the whole University and from participation in the management of its affairs, and if the students had been isolated from the realm of general scholarship. Useful work would undoubtedly have been done, but the potentialities of the unique scheme so successfully inaugurated by Lord Herries and his committee in 1890 would have been seriously trammelled.

Then there was the administrative question. For the time being the Department at Leeds was still governed by the Agricultural Committee of the College, while the newly acquired farm was not the property of the College and was managed by the Joint Agricultural Council. The Joint Agricultural Council approached the College with a resolution to the effect that, in their view, the work of the Agricultural Department of the College and of the farm should be combined under one body to be composed of the Joint Agricultural Council and of representatives of the College; and that the Principal and Secretary of the College should be invited to attend meetings. After conference with the College authorities this arrangement was approved with an agreement that there should be four representatives of the College on the Council. The Agricultural Committee of the College thereafter ceased to exist and the newly constituted Joint Council, with appropriate sub-committees, became both the advisory body to the College on the work of the Department, and also the body responsible to the County Councils for the management of the farm. Lord Herries, who had presided over the work from the beginning, now became Chairman of this Joint Agricultural Council.

It must be understood that the Department continued to serve the North Riding just as it had done previously, and that it was only in so far as it had no share yet in the tenancy of the farm

that the North Riding was not represented on the Joint Agricultural Council. When any matter, apart from routine work, that affected the North Riding was under consideration (and also when a Professor of Agriculture was to be appointed), North Riding representatives were to sit with members of the Joint Agricultural Council.

At the time of taking over the Manor Farm at Garforth there came the hiatus between Professor Muir's resignation in 1897 and Professor Campbell's appointment in the following year. During this period Dr. William (afterwards Sir William) Somerville, who was in charge of the Agricultural Department of the College of Science at Newcastle, gave considerable technical assistance in the planning of the experimental work. In later life Sir William Somerville used to speak with some pride of the fact that he was responsible for some of the experimental plots at Garforth which stood as striking demonstrations to students and farmers until the tenancy of the farm expired in 1928.

Although it was decided not to move the Department to Garforth, it was considered necessary to put up a small block of educational buildings comprising a few laboratories, a classroom, a board room and a dairy. These buildings were opened in 1901 by Earl Spencer, Chancellor of the Victoria University.

Miss A. D. McKerrow, who had been on the staff of the College as an itinerant instructress, was placed in charge of the Dairy and continued in that office, and in charge of the residential hostel for dairying students, until her retirement in 1925.

Dairying was throughout a prominent feature of the work at Garforth. In addition, feeding experiments, manurial and variety trials were all of great value to the College students and visitors. In later years the soil of the farm became subject to the influence of the acidity of the industrial atmosphere. This provided an opportunity for experimental work of a kind that gave valuable information on the treatment of soil and plants subjected to this sort of atmosphere, but it was also one contributing cause of the abandonment of the Manor Farm in 1928.

The University of Leeds and the Yorkshire Council for Agricultural Education.

In 1902 the North Riding County Council assumed a full participation in the scheme, and the Joint Agricultural Council was virtually succeeded by the Yorkshire Council for Agricultural Education, which continues as an annually appointed body to the present time. Actually, there is a Joint Committee of the three County Councils which meets once a year and appoints the Yorkshire Council for Agricultural Education, which is composed of members of the Joint Committee with added members,

including nominees of the University and of the Ministry of Agriculture.

Throughout these changes in the constitution and designation of the Council, Lord Herries continued to preside. He became the first Chairman of the new Yorkshire Council for Agricultural Education, and continued in that office until 1908, when he was succeeded by Major J. W. Dent, who held the office, and gave himself unsparingly to the work of the Council, for the next twenty years. Major F. H. Fawkes, who succeeded Major Dent and presided through the difficult times of a financial crisis, had unfortunately to relinquish the office after five years for reasons of health and was succeeded by the present Chairman, Sir Percy Jackson.

In 1904 the College became the University of Leeds, and the University, like the College before it, recognizes the Yorkshire Council for Agricultural Education as the advisory committee for its Agricultural Department. Appointments to the staff of the Department, for instance, are made by the University Council on the recommendation of the Agricultural Council.

The administrative officers of the original Joint Agricultural Council were the Clerks of the East and West Riding Technical Instruction Committees. On the formation of the Yorkshire Council and the inclusion of the North Riding in the farm Scheme, the Clerks of the East and West Riding County Councils together with the Secretary of the North Riding Education Committee became the three Joint Clerks of the Yorkshire Council for Agricultural Education. The Clerk to the West Riding Technical Instruction Committee, Mr. John Goulding, continued to work on behalf of the Clerks and on his appointment as Treasurer of the East Riding County Council the offices of the Yorkshire Council for Agricultural Education were located with him at Beverley. It would be difficult to exaggerate the importance of Mr. Goulding's contribution to the development of the work during his long tenure of the office of Assistant Clerk, from which he retired in 1930.

Following Mr. Goulding's retirement the office of the Yorkshire Council was moved to the West Riding headquarters at Wakefield, the duties of assistant clerk were divided between a member of the Clerk's Department at Wakefield and the Secretary of the Department of Agriculture.

FINANCE.

Yorkshire is one of the thirteen provinces into which the Ministry of Agriculture has divided England and Wales for certain purposes of agricultural education. In the other provinces there is an agricultural organizer in each of the counties of the province, and the Ministry of Agriculture pays a percentage of the net

expenditure on his work. There is also in each province an Agricultural College or University Department of Agriculture which receives a block grant from the Ministry of Agriculture.

In Yorkshire, however, not only the county work but also (except for some small items) the work of the University Department of Agriculture is financed by the Yorkshire Council, and the Ministry of Agriculture pays a percentage (at present 60 per cent.) of the Council's net expenditure on the whole work. The Ministry of Agriculture also, in fact, makes a block grant direct to the University, but this is deducted from the amount paid to the Yorkshire Council. It will be seen therefore that the amount of the block grant is immaterial and does not affect the amount paid by the Ministry to Agricultural Education in Yorkshire in any particular year; it only affects the distribution of the payment between the Treasurer of the University and the Treasurer of the Yorkshire Council. The mechanism of the block grant is retained presumably in order to preserve uniformity of practice throughout the country, and to provide the Ministry with the same facilities for contact with the University of Leeds as with other Universities possessing Agricultural Departments.

The County Council's payment is apportioned among the three Ridings in the following way: each Council pays such part of the expenditure as is determined by the Agricultural Council to have been incurred on behalf of that County Council. The residue of the expenditure and all capital money is defrayed in fixed proportions.

Pre-War Developments.

Following the changes that ensued after the leasing of the farm there was a period of development in all branches of the work up to the outbreak of war in 1914.

For in-University students the principal course was the three-years' course for the National Diploma in Agriculture. There was a degree course in which students could take Agriculture (with the usual ancillary subjects) along with either Pure Botany, Pure Chemistry or Pure Zoology, but there was not a large number of degree students in those pre-War days. In addition to the long course, a ten-weeks' course was introduced quite early on: it was very successful, but was unfortunately extended into a twenty-weeks' course, which change ultimately meant its undoing. A two-years' course was maintained for some time, but was ultimately abandoned.

In 1900 an arrangement was made with the Midland College that certain courses should be provided there and certain others by Leeds, so that students in either area could attend whichever college provided the course they required, and so that the duplication of courses at both centres might be avoided. The vigorous

growth of both institutions has, however, made such an arrangement unnecessary.

The teaching developments involved increases of staff. Quite early in the pre-War period Mr. Herbert Ingle was appointed Lecturer in Agricultural Chemistry, and after a few years of very successful work he was succeeded by Dr. Charles Crowther, whose development of the work is well known and led to the institution of a University Chair of Agricultural Chemistry. In 1912 a grant from the Development Commission made it possible to establish whole-time lectureships in Agricultural Botany and Zoology in place of the part-time services of the staff of the Biological Department of the University. The staff of nearly every section of the Department was then gradually increased as the work grew.

In 1913 there was established in association with the Department, an Animal Nutrition Research Institute, with Dr. Crowther, whose work had been the abundant justification for this development, as Director. Perhaps the most unfortunate effect of the War upon the Department was that it necessarily restricted the work of that Institute just as it had so well begun, and that after the War a combination of circumstances led to its fusion with the corresponding Institute at Cambridge.

In regard to County work, the chief developments in this period were the provision of horticultural classes and the rapidly increasing demands upon the staff for advice on specific problems. The agricultural classes also developed. Greater numbers of isolated lectures were given than in the early years, when only courses were provided. On the other hand such courses as were given were very much fuller and lasted over a longer period—sometimes three years. For a time instruction in farriery was much in demand.

Classes in dairying were still held in various parts of the county, but an increasing amount of the work was done at the fixed Dairy School at Garforth.

In 1912 the Council considered the possibilities of "Farm Institute" work according to a scheme of the Ministry. This did not necessarily involve the erection of *ad hoc* Institute buildings, but meant rather the establishment at various places in the County of teachers who should conduct, where premises could be engaged, systematic classes for those who could not come to the University. In essence it was a proposal to appoint additional members of staff who would be resident in the County and who could therefore more effectively and expeditiously develop the county classes. Three appointments under this scheme were to have been made when the War caused the whole scheme to be left in abeyance.

A year before the War the increase of the staff was found to

necessitate more accommodation, and it became necessary, as a temporary and rather inconvenient expedient, for the staff to be dispersed in different parts of the University premises. A scheme for erecting a departmental building was made possible by an anonymous gift of £10,000, to which the Board of Agriculture agreed to add a further £10,000. The erection of the building was another of the developments that was held up by the outbreak of War, and it was not until 1927 that the departmental staff were again gathered together under one roof.

Post-War Developments.

In-University Work.

During the War period teaching work was very greatly reduced, and when it was resumed in 1919 a most noticeable feature was the large number of degree students who entered the department. In pre-War days, as has been indicated, the bulk of the students took the diploma course, and degree students were very few. The high proportion of degree students that entered after the War has been maintained and increased in the years that have followed. Along with this greater entry for degree courses in Agriculture there has also been a change in the conception of the purpose of the degree course. In the earlier years it was assumed that a degree course was appropriate only to those people whose ambitions lay in salaried technical appointments, but the view has been gradually gaining ground that the intending farmer should, wherever possible, equip himself with the training provided in a full University degree course.

It has already been said that the earlier degree course in Agriculture admitted of Agriculture being taken along with some other University subject taught in another department. Shortly after the War the degree course in Agriculture was revised in such a way as to leave Agriculture alone as the principal subject, and so as to admit of the introduction of a greater number of ancillary subjects. There were also instituted honours degree courses in the agricultural sciences, so as to provide training for intending specialists.

The question of a central building had been laid aside in 1914 but inevitably came up again as a part of the post-War reconstruction, and it had a successful issue in the opening of the present building in 1927. It has already been mentioned that the question of transferring the building to the Farm was again debated, and with the result once again that the Department was allowed to remain in the precincts of the University.

Advisory Officers. At the time when the Ministry's Advisory Service was instituted in the country the Department at Leeds already had an advisory service for Yorkshire farmers, and instead

of adopting the Ministry's scheme in its entirety it was arranged to limit the hours of teaching of certain members of the staff who, in consideration of a grant from the Ministry, should devote themselves to advisory work, but who were otherwise not to be put under the conditions of the Ministry's Advisory Officers. That arrangement continued until quite recently, when the Ministry's normal scheme came into operation.

The development in the Advisory work since the War has been very great, as instanced by Dr. Ruston's notable contributions to Farm Economics.

County Work.

It has already been said that it was intended to appoint three lecturers to be stationed in the county, but that the War delayed the project. As soon as might be after the War this development took place, and four "District Lecturers" were appointed, each being allotted a separate area. Since then the number has been increased to seven. These District Lecturers, it must be understood, are members of the University staff in exactly the same sense as the members of the Department stationed at Leeds, and the fullest measure of co-operation is made possible between the in-University staff and the County staff.

In the years following these appointments considerable developments took place in the arrangement of evening classes and in the formation of farmers' discussion societies. These educational activities in the county are of different types, determined by local needs and convenience. At some centres an agricultural class lasting over two or three years is constituted as an activity of a Technical School, the Agricultural Department providing the teacher of agriculture, while the college supplies the teaching in such subjects as chemistry, botany and book-keeping. At one of these centres the class is held in the day-time on one day a week. Other classes held in the evening are confined almost entirely to agriculture itself, and are taken by the District Lecturers with the assistance of members of the in-University staff.

One thing that trammelled these developments was the difficulty of getting the youngest people, who were just entering the agricultural industry, to take appropriate classes in the county. Efforts were made to arrange classes for young people who had just left the elementary school, but the numbers who could be induced to come were impossibly small, and the desirable continuity between school education and subsequent post-school education was not easy to establish.

The work of establishing these classes was however not abandoned, and at least two influences have since led to their establishment at a number of centres in the province. One influence

has been that of the school teachers, who at various places have met in conference with the departmental staff, sometimes establishing local committees, and who have been able to convince numbers of young people that it is in their future interests to attend junior continuation classes in agricultural subjects. Another influence has been the development of the Young Farmers' Club movement, to which reference will be made a little later.

These classes for young people of fourteen to eighteen years of age are held in the day-time, one half of the day being devoted to agricultural subjects and the other to some manual work such as woodwork. At present the curriculum of these classes covers a period of three years. In the first year the study of general principles, in continuation of the school work, is carried on by making use of the rural environment and agricultural subjects. In the later years the work is more definitely vocational.

Young Farmers' Clubs. Young Farmers' Clubs have developed comparatively recently in Yorkshire, where there are now over thirty. A year ago the Yorkshire Clubs were formed into a County Federation which, on account of the great size of Yorkshire, is divided into regions corresponding to the areas allotted to the District Lecturers. The Department has defined its policy in the matter of Young Farmers' Clubs—it is considered to be a part of the business of members of the staff to assist in the initiation of clubs at suitable centres and in their development, provided that there is sufficient local voluntary leadership to enable the clubs not to be wholly dependent upon members of the staff. The newly formed Federation has an organic connection with the Department by the provision, in the constitution, that the secretary of the Department shall be the secretary of the Federation, and that various members of the staff shall be *ex-officio* members of the executive committee. In addition to this, the District Lecturers act as secretaries of the regions.

Horticulture.

Very little horticultural work has been done within the University and no immediate developments are contemplated. The horticultural staff are, of course, members of the University staff in the usual way. They do some teaching of students for the diploma in agriculture, they conduct a Saturday class for teachers, and also a class for students working in the Education Department of the University. The bulk of the work, however, is in the county.

By arrangement with the County Education Committees the school gardens, of which there are increasing numbers, are periodically visited and reported upon. There are also some

classes in the County for teachers, and other classes of a more general kind.

In 1921 the Agricultural Council leased a holding at Osgodby, near Selby, which was developed as a fruit demonstration centre, and which was also one of the centres for the Ministry of Agriculture's fruit trial plots. The work at Osgodby was carried out with notable success and was undoubtedly of great value to many Yorkshire growers. The holding has recently been given up and the fruit station transferred to the Council's farm at Askham Bryan. The only purpose of transferring this work from Osgodby to Askham Bryan was to centralize all the work which will concern Farm institute students.

Askham Bryan and the Proposed Farm Institute.

In 1927 the Agricultural Council, in anticipation of leaving Garforth in the following year, purchased two farms, comprising an area of 349 acres, at Askham Bryan, near York, where a good deal of work similar to that formerly done at Garforth has been carried out. At the time of this purchase a comprehensive scheme for establishing a residential farm institute was contemplated, but for various reasons it was not found practicable to go forward with the scheme at the time. The County Councils, however, gave approval to the scheme in principle, and agreed that certain alterations to buildings be made in the anticipation that the farm institute scheme would go forward at a later date.

In the meantime the Department has done what was possible to meet the educational needs of those who could not take a three-years' degree of diploma course, but who nevertheless needed some systematic instruction in the principles underlying crop and animal husbandry. The work that has been done in the County, particularly in connection with junior day classes, has already been referred to. In addition, a short course of ten weeks, from October to December, has been successfully held in the University during each of the last three years. It is now proposed to go forward with the Farm Institute at Askham Bryan, and so complete the scheme of Agricultural Education in Yorkshire.

It is proposed to erect an Institute capable of accommodating 120 students (although in the first instance residential accommodation will be provided only for sixty), and to provide three-term courses in Agriculture, Horticulture, Dairying and Poultry Husbandry, as well as short courses in Bee-keeping, Fruit and Vegetable Preservation, and other subjects that may appear desirable.

There will necessarily be a resident staff at the Institute, but the members of this staff, like all members of the Department,

will be members of the University staff, and the Institute will have some service from the staff resident in Leeds.

The development of this Institute work is in no way intended to replace the work which is at present done in the Department —apart from the ten-weeks' course. The Institute is considered to be necessary to provide, in an appropriate environment and with facilities for practical work, shorter courses than those given in Leeds. Moreover, it is definitely contemplated that some pupils, whose work at the Institute justifies it, will be able to go on to the University and take longer and fuller courses.

The farm will, of course, be the sphere of practical instruction of the Farm Institute pupils. In addition, it will serve as a demonstration centre for Yorkshire farmers and horticulturists. To fulfil these functions it is intended, with units of economic size, to demonstrate methods which make for high quality of produce in those branches of farming which are of greatest importance in the province. As measured by the value of produce, dairying is of first importance in each of the three Ridings, and a dairy unit of not less than forty cows, plus "followers," will be devoted to the production of certified milk. In respect of cattle for beef, the chief need is considered to be the demonstration of the type and quality of sire which should be used for crossing with the ordinary Shorthorn cow, and to this end a small Aberdeen-Angus breeding herd has been established.

The pig unit at Askham Bryan is now well known, and there is a breeding flock of Suffolk sheep.

The horticultural unit will be made up of three main sections: a fruit plantation, a market garden, and a section devoted to intensive cultivation.

Co-ordination.

The unity of County and University work in Yorkshire Agricultural Education originated in the fact that the co-operation of the County Councils was necessary to the original scheme of establishing an Agricultural Department in the Yorkshire College. As time has gone on more attention has been given to the potentialities of the scheme, and different parts of the work have been more and more closely co-ordinated. As the scheme now stands the Department has the means, through the Young Farmers' Clubs and through the day classes, of getting into touch with an increasing number of the young people entering the agricultural industry when they leave school. The contact made with these members of the Young Farmers' Clubs has certainly facilitated the development of the junior day classes. Moreover, it is now possible systematically and periodically to survey the members of the day classes, and to consider which of them should appropriately go on to Institute or University courses.

The fruits of this co-ordination are becoming increasingly apparent, and there are already within the University students who have come there by way of the Young Farmers' Clubs and day classes.

It must be emphasized that the development of this comprehensive scheme of agricultural education is now being definitely directed to the education of those who intend to farm. The provisions for training specialists are, for the time being at any rate, quite adequate.

Not only is it possible for the county activities to contribute to the in-University work, but the in-University staff are also able to give great assistance in the county work. For instance, the syllabuses of the day courses and all schemes of experimental work are designed jointly by the District Lecturers and appropriate members of the in-University staff, and experimental and other material is prepared in the Department at Leeds, where obviously there are greater facilities for it.

To what extent Lord Herries and his first committee appreciated the potentialities of their Scheme, and foresaw its probable development in fifty years, one does not know, but the subsequent developments and the increasing realization of the advantages of having College and County work under one organization, and committed to one staff, have clearly proved the wisdom and statesmanship with which the Department was started. The addition of a Farm Institute to this comprehensive scheme will, one hopes, give further evidence of the soundness of the foundation upon which Agricultural Education in Yorkshire has been built.

N. M. Comber.

The University,
Leeds.

THE SOCIETY'S GOLD MEDAL, 1935.

Lord Ernle, M.V.O., P.C.

Rowland Edmund Prothero, First Baron Ernle, has achieved distinction in many fields, and his services to agriculture have fully earned the highest honour that the Royal Agricultural Society of England can bestow.

Lord Ernle had a long experience of land administration. He was for twenty years Agent-in-Chief to the Duke of Bedford, in which capacity he managed and developed the very large agricultural estate of his employer "upon lines which were a model of efficiency." He was Member of Parliament for the University of Oxford from 1914 till 1919 and he served, at various times, as a member of many important Royal Commissions and Departmental Committees. Finally he was

President of the Board of Agriculture during the years 1916–19, when the country had to face an unexampled food crisis and when, consequently, our home agriculture was called upon to make unprecedented efforts.

It is rare to find a high capacity for practical administration combined with eminence in scholarship and learning, yet Lord Ernle is a very distinguished historian and man of letters. He is the author of more than a dozen major works and of a very large number of literary and historical essays. He was Editor of the *Quarterly Review* from 1894 till 1899.

Lord Ernle's knowledge of agriculture and his equipment as an historian combined to make him the ideal writer of an authoritative history of agriculture, and he is best known to present-day agriculturists (and perhaps will be longest remembered) as the author of " English Farming Past and Present."

THE SOCIETY'S GOLD MEDAL, 1934.

SIR ARNOLD THEILER, K.C.M.G.

THE development of Agriculture in the New Countries of the Overseas Empire has been an immense undertaking, which has required the services of great numbers of scientific men. Specially distinguished among these is Sir Arnold Theiler, whose life-work has been summed up by saying that he " made the Dominion of South Africa habitable by the domesticated animals."

Sir Arnold was born in Switzerland and was trained in Veterinary Medicine at the University of Berne. He went to South Africa in 1891 and received his first public appointment, as Government Veterinary Officer to the South African Republic, in 1896. Thereafter he was called to fill one important post after another and finally, in 1923, became Dean of the Faculty of Veterinary Science in the University of South Africa. He retired in 1927.

Sir Arnold, in the course of his long career, had to deal with a great variety of stock diseases, from those caused by protozoan parasites and bacteria to those induced by mineral deficiencies or by poisonous plants. When he began, practically nothing was known of the pathology of most of the South African diseases; when he retired the majority of the bigger problems had been cleared up either through his own brilliant investigations or through those of others whom he trained and directed. Not only did he solve a large number of difficult local problems, but he devised methods of investigation which have been proved extremely fruitful of results in the hands of workers elsewhere.

Stockmen throughout the world owe Sir Arnold Theiler an immense debt of gratitute and the Royal Agricultural Society of England has added its name to the long list of Societies who have recognized his brilliant services.

THE LATE MR. ALFRED MANSELL.

MEMBERS of the Society will wish to see recorded the services to Agriculture of one of the most distinguished members of the Council, who died in June last at the age of eighty-one years.

Alfred Mansell came of an old farming family and "served his articles" as an Estate Agent and Valuer in the country town of Biggleswade in Bedfordshire. In 1876, at the age of twenty-two, he set up in business on his own account and began to build up what was destined to become the world-famous firm of Alfred Mansell & Co., Auctioneers, Valuers, Estate Agents and Live Stock Exporters, of College Hill, Shrewsbury. Some idea of the scale of that business will be conveyed when it is said that it passes through its sale rings about 30,000 head of cattle annually and that, in the pre-war period, it was shipping pedigree animals overseas at the rate of nearly 2,000 head a year.

Mr. Mansell was a man of extraordinary versatility—an expert land valuer and arbitrator, a highly competent judge of many different classes of stock and a trustworthy guide on points of agricultural law. His remarkable judgment and his unquestioned integrity combined to win for him the implicit trust of a very wide circle of agriculturists, from his nearest neighbours in Shropshire to his most distant clients in New Zealand and Australia.

In several matters he played the role of a pioneer. For example, he took a leading part in forming the Shropshire Sheep Breeders' Association and was the editor of its Flock Book, the earliest register of its kind for any breed of sheep. His firm was also, so far as can be discovered, the first to install a weighbridge in its cattle market. This was in 1881.

Besides exercising control of his large business, Mr. Mansell farmed on an extensive scale, wrote many articles in Agricultural periodicals and published a "History of Shropshire Sheep" and "The Management of Pure Bred Flocks." In 1903 he lectured before the Royal United Services Institution on "Food Stuffs in Time of War," and displayed, as subsequent events proved, an almost uncanny gift of phophecy.

Most men would have found their energies overtaxed by the activities that have already been mentioned, but Mr. Mansell found time to do an immense amount of public work, both locally and nationally, not only for agriculture but for other causes. A catalogue of his public activities would run to many pages, but their wide range may be indicated by a few examples. He held, at various times, the offices of Chairman of the Farmers' Club, Chairman of the Agricultural Committee of the Auctioneers' Institute, and President of the National Sheep Breeders'

Association. He was a Governor of the Harper Adams Agricultural College; a member of the Shropshire County Council; Secretary of the Shropshire Chamber of Agriculture and of the Shropshire Branch of the Royal Agricultural Benevolent Institution; and Chairman, for the long period of fifteen years, of the Royal Salop Infirmary.

He was a member of Council of the Royal Agricultural Society from 1909 to 1935 and his wide knowledge and wise judgment were of the utmost value on many of its Committees. Moreover, his unassuming manner, his unfailing courtesy and his inexhaustible willingness to assist any good cause, won him something more than the esteem of those who knew him.

REPORT OF THE RESEARCH COMMITTEE.

THE Society's Research Committee has found it possible, during the past year, to provide funds for a considerably increased number of research projects. Grants have been continued towards three schemes which had been in operation in previous years, and new grants have been made in respect of five more.

I.—WORK COMPLETED.

The important series of experiments on the utilization of the by-products of the sugar-beet crop, conducted at the Norfolk Agricultural Station, has been completed. The last report, which appears on p. 148, describes experiments on the manurial effects of sugar-beet tops when fed to sheep on the land and when ploughed in. The following is a list of the reports published in previous volumes of the *Journal*.

(1) "Bullock Feeding on Sugar-Beet Tops and Pulp." By S. T. Johnson, Vol. 90, p. 182.

(2) "Bullock Feeding on Sugar-Beet Tops." By F. Rayns, M.A., Vol. 93, p. 214.

(3) "Sheep Fattening on Sugar-Beet Tops." By F. Rayns, M.A., Vol. 94, p. 151.

It seems to the Committee that it would be useful to publish a general summary and discussion of the whole series of experiments, and it is hoped to arrange for this in the next issue of the *Journal*.

II.—WORK CONTINUED FROM PREVIOUS YEARS.

ROYAL VETERINARY COLLEGE, LONDON.

MASTITIS IN COWS.

Completed work on this subject at the Research Institute,

Royal Veterinary College, London, during the year 1934–35 comprises the following :—

Control of Streptococcus Mastitis.—Reference should be made to the two immediately preceding reports to the Research Committee for information as to the earlier progress of this work. In brief, observations have been proceeding in seven herds carrying at the start some 550 cows, in each of which from 30 to 55 per cent. were infected with the streptococci which cause the contagious form of the disease. Tests of the milk of individual animals have been made at intervals of three to six months for the past four to six years, and cows found to be infected have been milked last. The object has been to assess the chances of eradication by this comparatively simple method. In two herds the results have been highly successful since in one case the herd has now been free for six years and in the other case for three years. In the first of these two eradication was facilitated by the use of separate premises and in the second by the owner's decision to reduce his herd, when the opportunity was taken to dispose of infected animals. With the five remaining herds the results, on the whole, have been less satisfactory. In two of these, however, which are under one management, no serious attempt has been made at control although until recently testing was continued regularly. The three other herds are of greater interest because what seemed to be reasonably adequate precautions were taken to prevent the disease from spreading. In the first of these, new infections have continued to appear from time to time in the healthy group, but nearly all the cases have been extremely mild and would not have been recognized without special laboratory examination of the milk ; moreover, with many cows infection has disappeared entirely and without treatment. In the second herd new infections have also appeared at intervals, probably owing to two factors, viz., the constant presence of infected animals in neighbouring sheds and the retention of such animals on the farm much longer than would normally have been the case, on account of their high pedigree breeding value. The third herd consisted, during 1931 and 1932, of three groups of animals, each group being housed on separate premises and looked after by separate attendants. An endeavour was made to free two of these groups from infection by moving diseased cows to the third set of premises. This policy, in general, has been successful and infection has been kept well under control. Early in 1933 the owner decided to collect a fourth group of animals and the advice was followed that this should be built up solely from freshly calved heifers, which would be kept isolated from the other three groups. Up to the present this plan has succeeded well and only two out of forty-five animals have become infected.

Details of the foregoing observations are to be published in December, 1935. Valuable experience has now been gained as to the possibilities of controlling contagious mastitis. Under the best conditions of working and with full collaboration from the owner the experience shows that success is likely to be achieved. The great advantages, where possible, of assembling a heifer herd apart from older cows has been shown, and it may be pointed out incidentally that the advantages concern not only mastitis but also other diseases, *e.g.*, contagious abortion. On the other hand, where a large group of infected animals has to be maintained on the same premises, control by the means adopted may prove difficult. In such conditions, which are of course those present in the majority of herds, treatment of cows with a view to ridding them of infection should greatly assist matters, since experiments have shown that by infusing into the udder certain chemicals, viz., some of the so-called "acridine" compounds, mastitis streptococci can often be effectually destroyed. Treatment on these lines, and especially the milking of *all* infected cows last, combined with other measures to prevent the spreading of the disease, would be well worthy of thorough and extended investigation.

ROTHAMSTED EXPERIMENTAL STATION.

The Use of Electric Power.

During the year ending September 30th, 1935, the comparisons between electric motors and internal combustion engines have been confined to threshing operations.

In these experiments, a portable motor and two International Harvester Company tractors were compared as sources of power for driving a threshing machine with a 48-inch drum.

At the time of the experiments, the old tractor was in its seventh, the new tractor in its first, and the electrical equipment in its third working year.

All the results obtained refer to stacks built in close proximity to the farm buildings.

The mean outputs of grain and straw in cwt. per hour, to which the following power consumptions refer, were as follows :—

	Oats.	*Wheat.*	*Barley.*
Grain	19·8	25·2	20·8
Straw	28·1	34·3	22·1

The average electricity consumption per hour by the motor was 8·0 kWh, corresponding to a mean power output of 9·3 h.p. The average paraffin consumption was 1·39 and 1·31 gallons per hour for the new and old tractors respectively. Apparently the new tractor was run on rather a rich fuel mixture.

The hourly overhead costs were calculated from the annual values, the life of the tractor being taken as eight years, that of

he motor as twenty years, and that of the circuit as twenty-five years. The annual depreciation and interest charges were calculated on the values of the plant for the given year, the rate of depreciation being that allowed for income tax purposes (22½ per cent. for the tractors, 7½ per cent. for the electric motors).

At Rothamsted the annual use amounts to 1,000 hours for the tractors, and 200 hours for the motor and circuit. The charges per hour were therefore :—

	Electrical Equipment.	*New Tractor.*	*Old Tractor.*
Electricity	11·4*d.*	10·2*d.*	9·75*d.*
or Paraffin	(8·0 kWh at 1·42*d.*)	(1·39 galls. at 6*d.*)	(0·31 galls. at 6*d.*)
Overheads ...	13·8*d.*	15·2*d.*	4·72*d.*
Totals ...	25·2*d.*	25·4*d.*	14·5*d.*

Owing, in the main, to its low value in the seventh year, the older tractor was the cheapest source of power.

The above costs would not, presumably, apply to a commercial farmer, whose electrical equipment would be expected to be less detailed than that at Rothamsted, giving rise to a greater annual use of the motor, *e.g.*, the motor might be in use 500 hours per annum as compared with 200 at Rothamsted. In addition, the 20 h.p. unit could be replaced, with advantage, by one of 15 h.p. On the commercial farm, then, the overhead costs per hour for electricity would be less than those given above. Assuming the same power costs as at Rothamsted, and taking a mean value of the overheads over the working life of the plant, the costs for the commercial undertaking would be :—

	Electrical Equipment.	*Tractor.*
Fuel or Electricity	11·4*d.*	10·1*d.*
Overheads ...	4·8*d.*	9·4*d.*
	16·2*d.*	19·5*d.*

With the total charge for the tractor at 19·5*d.* per hour, and the overheads for electricity at 4·8*d.* per hour, then the total costs would be the same if the price of one hour's electricity was 14·7*d.*; *i.e.*, if the nett price was 1·85*d.* per kWh, this figure including an allowance for any charges such as quarterly fixed charges.

BACTERIOLOGY DEPARTMENT.

Summary of Recent and Current Work on the Legume Nodule Bacteria.

1. *Strains of Clover Bacteria.*—Now that lucerne seed inoculation has proved a practical success, the possibility of improving the growth of clover by means of inoculation is being studied. In the case of lucerne inoculation we had to deal

with a relatively simple problem, namely, the absence from the soil of the species of nodule organism that infects lucerne.

Clover presents us with a much more complicated problem. The soils of this country almost always contain the clover nodule bacteria, but the quality of these organisms is very variable. There exist races which fail entirely to benefit the plant on which they form nodules. The problem was particularly brought before us by the weakness of clover in Welsh mountain pastures, whence we have isolated such non-effective strains of clover nodule bacteria. We have found in the course of pot experiments that the Welsh non-effective strains have the power to prevent or check the entry of most of the beneficial strains of clover nodule bacteria. This largely increases the harm which they do, because their presence in a soil sown with clover may not only result in the clover being infected by the non-effective strains, but may prevent beneficial bacteria from infecting the clover. The existence of these harmful strains of clover bacteria has thus raised the problem of the cause of their antagonistic action towards the good strains, and necessitates the discovery of good strains resistant to this antagonism, before we can hope to improve the existing state of affairs by inoculation. Last year we discovered that, of the many strains of clover bacteria tested, two gave an improvement in clover growth even in competition with the harmful Welsh strain. It is hoped that we may be able to make a widespread test of the effects of clover inoculation with these strains on soils likely to contain harmful strains.

The problem of the cause of strain antagonism is being studied. We have evidence suggesting that there is actual competition between the good and bad strains in the soil outside the plant. The factors controlling this competition are now being studied in the laboratory in the hope of discovering the right soil conditions to stimulate the good, and to discourage the non-effective, strains of nodule bacteria.

2. *Secretion of active substance by legume roots.*—The observation was made some years ago that nodules on lucerne hardly ever commenced to appear until the seedlings had reached a certain stage of development. It has now been found that lucerne roots secrete a substance which stimulates the growth of the nodule bacteria in their vicinity. This stimulant must play an important part in the process of legume infection by the nodule bacteria.

Its action and properties are being studied.

3. *The action of nitrates in checking nodule formation.*—The harmful action of mineral nitrogen on nodule formation has

been studied for some years. It has been shown that nitrates and ammonium salts protect the root hairs of the host plant against infection and against the characteristic deformation which necessarily precedes this infection. This season, it has been found that this action of nitrate can be mitigated by the supply of dextrose to the plant, from which it seems a fair deduction that the injurious action of nitrate on nodule formation is due to a lowering of the concentration of free carbohydrate, some of which is combined with the nitrogen to form protein. This lowering will not occur when increased top growth and consequent photosynthesis makes up for loss of carbohydrate.

For this reason small doses of nitrate given to a young legume may actually increase nodule formation and be beneficial to nitrogen fixation, provided that they stimulate sufficiently rapid growth of the plant. Nitrates will not usually produce the necessary increased growth of legumes unless these are growing alone and free from the competition of other plants, but under such conditions some examples of nodule formation being benefited by nitrates have in fact been observed by other workers.

III.—WORK BEGUN IN 1934.

UNIVERSITY OF DURHAM.
(Armstrong College, Newcastle-on-Tyne.)

AN EXPERIMENT ON THE ERADICATION OF THE COMMON SHEEP "TICK" (*IXODES RICINUS*).

The well-founded suspicions of sheep farmers have been fully confirmed by the recent discovery that the common sheep "tick" is the carrier of two important sheep diseases, namely Louping Ill and tick-borne fever, and this knowledge has given fresh impetus to research into the possibility of eradicating this pest from sheep grazings.

The areas which are tick infested are slowly increasing, and it is remarkable that certain valleys in the north of England are at present free from ticks while neighbouring ones are heavily infested. This does not appear to be due to any fundamental differences in the nature of these sheep walks, but merely to the fact that the tick-free valleys have not yet been infected. It is common knowledge that within living memory ticks have appeared on many farms, where they have caused serious depreciation of the sheep stocks. Flockmasters are realizing that ticks are responsible for serious wastage among sheep, and the Management Committee of the Alan Duke of Northumberland Memorial Fund has had a definite request to take active steps to control ticks in a heavily infected valley in Northumberland. In this valley there are eight valuable sheep farms, all tick-infested, and the landlord, agent and tenants have promised

their co-operation in any steps which may be devised for the partial or total eradication of ticks.

According to recent researches on the subject, the only practical method of controlling ticks on sheep walks is by a campaign of serial dippings. By this method the hoggs, young sheep and eild ewes are placed on tick-infested pastures during the months of April and May, and are used for the purpose of collecting ticks at various stages of development. These sheep are then dipped at weekly intervals with a special arsenical dip. In all, six dippings are necessary. There is no doubt that this method effects a reduction in the number of ticks, and it may even, if it is continued in successive years, result in their eradication. No experiment on these lines has ever been undertaken on an organized basis, and it is believed that the Society's grant will make it possible to demonstrate the possibilities of such a campaign.

The work is being carried out under Mr. W. Lyle Stewart, M.R.C.V.S., the Veterinary Research Officer for the Northern Province. It is hoped that a fairly full interim report on the progress of the experiment will appear in the next issue of the *Journal.*

THE UNIVERSITY FARM, CAMBRIDGE.

The Rationing of Bacon Pigs.

The object of this experiment is to compare, with special reference to costs of production and carcase grades, the results obtained by the restricted versus the practically unrestricted feeding of bacon pigs.

One half of the pigs are fed to appetite, *i.e.*, are given as much food as they will "clean up" at two or three meals per day; the other half receive a certain proportion of this amount, whatever it may be. The animals are paired, one number of each pair being fed on the full allowance and the other on the restricted ration. Each animal is fed individually.

The investigation is being carried out under the supervision of Mr. W. S. Mansfield, the Director of the Cambridge University Farm.

Although the work is still in progress, one series of trials has been concluded, and has provided very definite evidence on the question of the relative economy of the two methods, *i.e.*, on the "efficiency ratio" of food consumption to live-weight increase. The results seem to the Committee to be of such interest that it has been decided to publish these in the form of a preliminary report. This report, by Mr. Mansfield, appears at p. 137. A full report will, of course, appear after the conclusion of the investigation.

WELSH PLANT BREEDING STATION, ABERYSTWYTH.

GRASS-SEEDS MIXTURE TRIALS.

The object of this experiment is to obtain information on the applicability, over a wide range of conditions in England, of a simple type of grass-seeds mixture, containing pedigree strains of grasses, in forming a pasture sward of high productivity and long-lasting capacity. The mixture used will consist predominantly of the pedigree strains of grasses which have been produced at the Welsh Plant Breeding Station.

Trials with a mixture of the type in question were laid down in every county in Wales in 1931. The experimental fields are now creating widespread interest and are showing the undoubted advantage of pedigree leafy strains over the common types of commerce. It is now intended to lay down trial areas, amounting in all to not less than 100 acres, in various widely scattered areas of England. The mixture to be sown will consist of :—

	lb. per acre.
Pedigree Perennial Ryegrass	14
Pedigree Cocksfoot	6
Pedigree Timothy	6
Rough-stalked Meadow Grass	1
Montgomery Red Clover	5
Wild White Clover	1

Adequate supplies of the pedigree seeds are not at present available and therefore the first stage of the work is the production of these seeds in the required amounts.

The pedigree strains of grasses (perennial ryegrass, cocksfoot and timothy) sown in the spring of 1935 so as to produce seed for the mixture trials in 1936 were all established successfully.

The severe drought during the summer months imposed a considerable check on growth, but the September rain enabled the ryegrass and timothy to make satisfactory progress. The effect of the drought was rather more pronounced in the cocksfoot, partly owing to the somewhat later sowing and partly due to the lighter soil conditions. A mild autumn, however, should conduce to satisfactory development in the three species of grasses, so as to warrant the expectation of normal seed crops in 1936.

NORFOLK AGRICULTURAL STATION.

THE CUMULATIVE EFFECTS, ON A LIGHT ARABLE SOIL, OF VARIOUS METHODS FOR THE DISPOSAL OF SUGAR-BEET TOPS AND STRAW.

It is a matter of common knowledge that the traditional method of maintaining the fertility of arable land, by means of the dung from fattening bullocks, has become increasingly expensive in recent years; the price of fat cattle has been so low that, in order to show an approximate balance on the operation of fattening, a very high value has had to be placed upon the manure.

Many farmers believe, nevertheless, that any attempt to farm without dung must lead to ultimate soil exhaustion and financial disaster. At the other extreme is the view, underlying the practice of certain mechanized corn farmers, that cereal crops can be grown successively, and more or less indefinitely, with no manures except artificials. There is again a third possible system of manuring, whereby the humus content of the soil might be maintained without the keeping of stock. This would involve the return to the land, directly, of straw, sugar-beet tops and other by-products of the cash crops. This series of experiments is designed to provide information on the gain or loss of fertility, over a period of years, of land farmed on the systems indicated above, with certain variations and combinations of treatments.

The land will be farmed on a five course rotation of (1) sugar beet, (2) barley, (3) "seeds", (4) wheat and (5) barley.

There will be fourteen main treatments, as follows :—

1. Beet tops sheep folded on the land once in five years :
   (*a*) Alone ;
   (*b*) With straw in sheep folds ;
   (*c*) With straw in sheep folds and straw folded on the young "seeds" ;
   (*d*) With straw ploughed in for beet ; straw in the sheep folds, and straw folded on the young "seeds."
2. Beet tops ploughed in once in five years :
   (*a*) Alone ;
   (*b*) With straw ploughed in with the tops ;
   (*c*) With straw ploughed in with the tops, and spread on the young "seeds" ;
   (*d*) With straw ploughed in for beet ; with the beet tops, and spread on the young "seeds" ;
   (*e*) No straw ploughed in with tops, but straw ploughed in for beet ; for second barley crop ; and spread on young "seeds."
3. Farmyard manure ploughed in for beet and for wheat in each rotation :
   (*a*) With all beet tops carted off ;
   (*b*) With beet tops folded on the land ;
   (*c*) With beet tops ploughed in.
4. All beet tops carted off and no farmyard manure applied :
   (*a*) With no straw ploughed in ;
   (*b*) With straw ploughed in for beet ; for second barley crop ; and spread on young "seeds."

The plots will be sub-divided to compare the effect of two applications of artificials in each rotation (for sugar beet and second barley crop) and also to test the effect of single and

double doses of nitrogen in assisting the decomposition of the ploughed-in straw.

EAST MALLING EXPERIMENTAL STATION.

Investigations into the Improvement of Walnut Culture in England.

Suitable Varieties.

The selection of a limited number of varieties of Walnuts capable of standing English climatic conditions was very materially assisted by the severe frost on May 16th–17th of 11·5 degrees.

Whilst subsequent observations showed that the majority of the fifty-two varieties in the East Malling collection were badly injured and the flower parts destroyed for the season, some of the late-leafing varieties which have already been sent out for testing, such as Franquette, Mayette and one of the selected English seedlings, suffered little and bore an appreciable crop of nuts.

Very careful records were taken subsequent to the frost damage of the early growth, and it appears that the frost has resulted in stimulating the lower buds into making short fruiting spurs which should bear a crop next season, given favourable weather conditions. These first crops will be very valuable as an indication of the quality of these nuts under English conditions.

Identification of Selected Varieties on Vegetative Characters.

At present there is no means of distinguishing even the selected varieties with certainty. A preliminary survey of the leaf characters of a number of English and French varieties has revealed differences in foliage characters, such as angle of leaf to stem, length of rachis, space and size of leaflets thereon, etc., and it is thought that important varieties may be grouped according to the above characters. Other lines of identification —of which nut characters should be important—are being explored.

Propagation.

(a) *Rootstocks.*—At present seedling rootstocks of *Juglans regia* and *J. nigra* have to be relied on, though it is not yet known what influence, if any, seedlings of these species may have on the subsequent behaviour of the tree.

Meanwhile a promising beginning has been made by applying layering methods in order to obtain vegetatively raised clonal root systems. Certain hybrids of *J. regia* and *J. nigra* cross with *J. californica*—known respectively as Paradox and Royal—root fairly readily and have now been successfully grafted with some of the selected varieties.

The results appear to be as promising as those obtained by grafting upon seedling rootstocks, and the progeny should be more uniform.

(b) *Grafting and budding.*—Whilst little further improvement seems necessary in the methods of indoor grafting which have been successfully evolved at East Malling to meet English conditions, methods of outdoor propagation—which should cheapen the process—are still being sought. Grafting in the open has proved very precarious because the walnut is very slow to form callus tissue and the scions dry out before the union has been obtained.

Experiments in outdoor budding have been continued, and promise much greater success. Buds of the previous season's woods are inserted in May and June and start into growth the same year. If this method continues to be as successful as the early experiments suggest, it could be used on seedling trees of up to twenty-five years old so as to "over-work" them to a named variety.

Rootstock Trial.

The small grove of Franquette and Mayette on seedling *regia*, *nigra* and *californica* stocks is being kept under observation, and a more complete series of trees on different rootstocks is being raised for a more extended trial.

Distribution of Varieties.

Now that the simple glasshouse method of propagation has been demonstrated to nurserymen, the main stock of the twelve selected varieties has been handed over to four firms as a nucleus for further propagation. Young trees from these sources should be available to growers in the near future.

Contact is being maintained with the sets of experimental trees placed in different parts of the country to test their suitability under various conditions.

The demand for trees of named varieties is now far exceeding the supply at East Malling, since resources now only permit of the raising of very few for experimental purposes.

Pruning and Form of Tree.

Pending the discovery of any dwarfing rootstock, an experiment in shaping and pruning walnuts as bush trees for small gardens has been undertaken. Preliminary results suggest that summer pinching may both restrict growth and encourage early fruitfulness.

Control of Diseases.

The spraying with Bordeaux Mixture (8 : 8 : 100) of trees suffering with Bacterial Blight, which has already been described, has been applied successfully to control the disease.

The sterilization of the rootstocks before grafting with a 1 per cent. solution of formalin, in order to prevent graft disease caused by a fungus named *Chalaropsis thielavioides*, already fully described, has again been undertaken with complete success.

A full account of the work is given in the Royal Horticultural Society's *Journal* for November, 1935.

INTERIM REPORT OF PIG FEEDING EXPERIMENT CONDUCTED ON THE CAMBRIDGE UNIVERSITY FARM DURING 1935.

For many years it has been a commonly accepted maxim among the pundits of agricultural science that the animal that is fit for slaughter at the earliest age is the most economical and the most profitable. Some, however, have for long had an uneasy feeling that the matter could not be dismissed so summarily, though it is only within the last few years that any real evidence has been forthcoming to contravert what had become almost a dogma. If it really be true that the rapid fattening of animals is the most profitable, then it follows that the large majority of British farmers are wrong, for these quickly finished animals are very much in a minority. Most agricultural scientists, however, have a great and growing respect for the farmer, and would, particularly in these days, hesitate to condemn an opinion firmly held by any large body of practical men.

The argument that the animal that is fit to slaughter at the earliest age is the most economical is based on the fact that an animal requires a certain amount of food for its maintenance every day of its life; therefore the shorter its life the smaller will be the total quantity of food required for this purpose. But this disregards any variation in the efficiency of production. It is quite possible for there to be so great a variation in this efficiency as to vitiate the whole argument. The argument becomes still more complicated when applied to the pig, for since the inception of the Pig Marketing Board further uncertainties have arisen. We have no definite information as to how far rapidity of fattening affects the quality of carcase and therefore its grading. It is clear that further information is required on these points, and the experiment that is to be described has been initiated on the Cambridge University Farm with this end in view. This experiment has been made possible by a grant from the Research Committee of the Royal Agricultural Society, to whom the authors would like to express their gratitude.

Briefly the experiment consists of the individual feeding, from weaning to bacon weight, of one hundred pigs of the same breed and strain. Each pig is fed separately, so that the precise amount of meal each animal consumes is known. Half the pigs are fed to appetite, the other half are fed on a restricted ration. The food is of the same standard mixture in both cases. When bacon weight is reached the pigs are slaughtered, graded, and various additional measurements are taken.

It will be noted that the essential feature of the experiment is that the whole of the pigs are fed individually. From the data thus obtained it is anticipated that information will be gained on the following points :—

1. The cost, in terms of food consumed per pound of live- and dead-weight gain, of pigs fed on a low plane of nutrition as opposed to pigs fed on a high plane of nutrition.
2. The difference, if any, in grading between pigs fed on high and low planes of nutrition.
3. The difference, if any, of the food consumption per pound of live- and dead-weight gain of pigs of different grades.

It was realized that it would not be possible to feed separately 100 pigs in one batch, and in practice it was found impossible to manage more than forty at a time. It is to the first batch of forty pigs that the following data relate. The experiment is at the moment in process of being repeated with a second batch, but the results obtained from the first forty were in certain respects so definite and conclusive that we felt justified in publishing them at the earliest possible moment in the form of this interim report. It must, however, be clearly understood that these findings await final confirmation until the results of at least one more lot are obtained.

The "building" in which the experiment took place was an old permanent lambing pen, long disused. In this place twenty pens, 7 ft. 6 in. by 5 ft. 6 in., were made. Each of these pens housed a pair of pigs. Provision was made so that at feeding time a second and adjoining pen was available in which one of the pair could be fed. Thus, though each pig was fed separately, they lived together in pairs.

The pigs used were pure-bred Large Whites from the old-established Cambridge University Farm herd. They were the progeny of seven different sows and three different boars. It should here be explained that the sows in this herd are not quite typical of the breed. They have been selected for many generations for fecundity and thriftiness and certain other characteristics. The result is a strain of somewhat smaller size than the average of the breed, fine in the bone and in some ways approaching a pork type. The aim, in fact, has been to produce a strain that would serve as a "dual purpose" one.

The three boars were from three different herds, where the breeding aims at producing pigs of genuinely bacon type.

The forty pigs that comprised this batch were selected and brought into the pens in February, 1935, when they were about eleven weeks old. They were all from large litters and, being November and December born pigs reared under somewhat rough conditions, had not had a good start in life. On arrival in their new quarters they were paired. Each pair consisted either of two litter brothers or of two litter sisters. In no case did the difference in weight, between the two members of a pair, exceed one pound. Each of these pairs occupied one pen, except at feeding time. They were therefore exactly comparable.

For the first period of their lives the pigs were all fed alike, each being allowed to eat as much food as it would clear up in twenty minutes three times a day. The mixture used in this first period was as follows :—

Weatings (Best English) . . .	40%
Barley Meal (English) . . .	20%
Flaked Maize	30%
Fish Meal (Best White) . . .	10%

The food was fed wet, warm water being added immediately before feeding.

The pigs were weighed weekly and the difference in feeding was introduced as each pair reached 65 lb. live weight. In half the pairs, chosen at random, the pig which first attained 65 lb. was restricted, while in the remaining ten pairs the leading pig was unrestricted. The unrestricted pig of each pair continued to receive all the food it would consume in two feeds of half an hour each. The other pig, until it reached a live weight of 100 lb., was restricted to three-quarters of what its fellow ate when at the same weight, and thereafter to two-thirds of its fellow's consumption.

After the live weight of 65 lb. had been attained, the ration was changed, and from then onwards consisted of the following mixture :—

Weatings (Best English) . . .	25%
Barley Meal (English) . . .	30%
Wheat Meal (English) . . .	15%
Yellow Maize Meal	20%
Fish Meal (Best White) . . .	10%

Throughout the period every pig frequently had a small portion of some form of green stuff, either Kale or Lucerne, which is not included in the weight of food.

All the pigs were wormed shortly after the beginning of the experiment. The general health was good throughout. No. 1027 suffered from some slight respiratory trouble, No. 1073 was a very slow feeder, and No. 1086 was rather a wasteful feeder.

FIG. 1.—Pair No. XII; right, No. 1056 (full feeding), 216 lb. l.w.; left, No. 1059 (restricted feeding), 176 lb. l.w.

FIG. 2.—Front view of Pair No. XII.

FIG. 3.—Rear view of Pair No. XII.

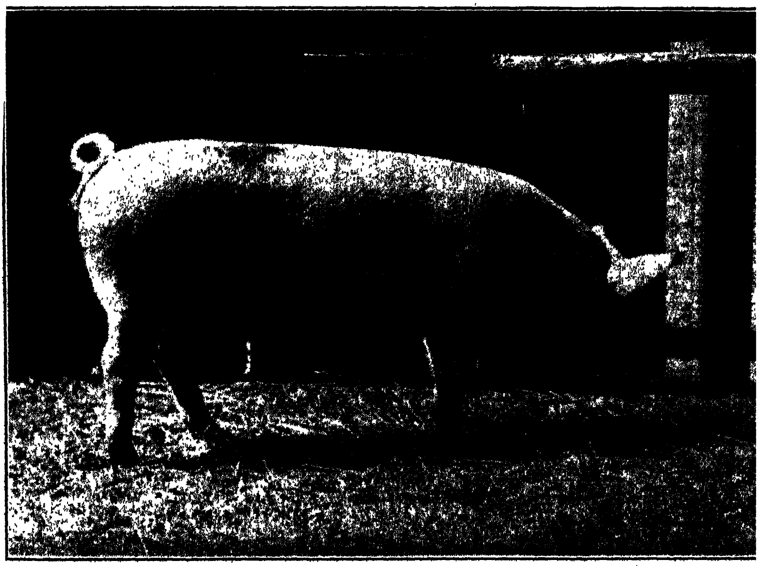
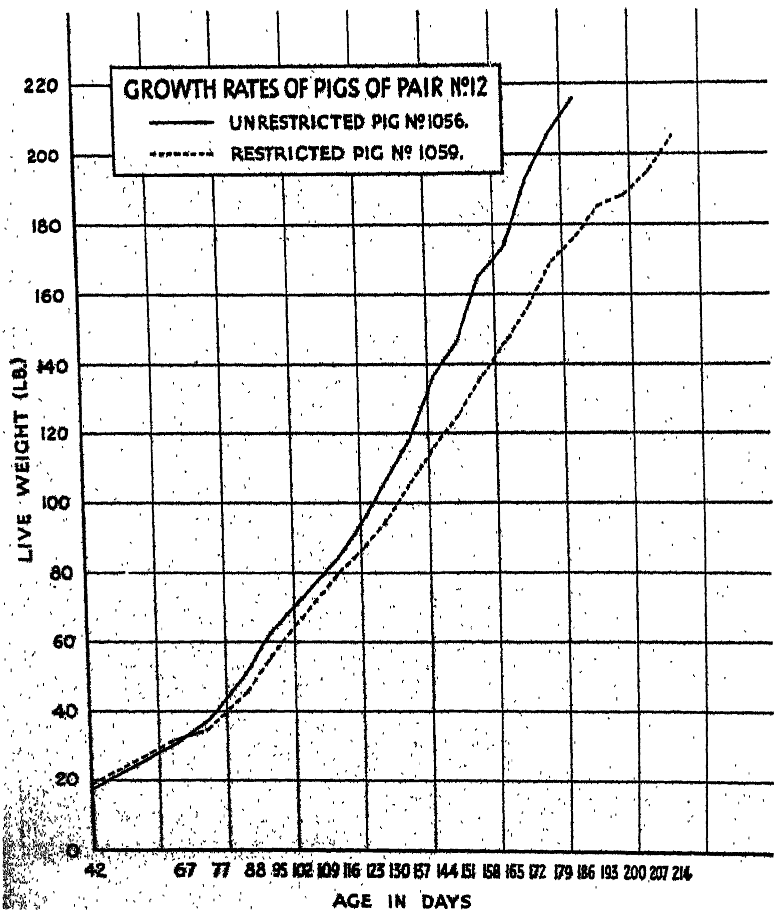


FIG. 4.—Pig No. 1059 (restricted feeding), at 204 lb. l.w.

A difference soon became apparent between the pigs in each pair, a difference not simply of size but of conformation. This became apparent when the unrestricted pigs weighed about 110 lb., at which time their restricted fellows were weighing about 95 lb. From this time onwards the difference became more and more marked. The unrestricted pigs took on the typical appearance of pork pigs, being fat, thick-set and jowly, and looked short in comparison with their fellows. The restricted pigs, on the other hand, had the appearance of typical bacon pigs, being much thinner, longer on the leg, lighter in the shoulders and the jowl; they also seemed much longer in the back, though actual measurement proved that in this respect there was no real difference. The difference in type had to be seen to be believed, and



during the spring and early summer these pigs were quite the most striking thing to be seen on the farm. The photographs of pair No. XII give a good idea of this. Fig. 1 was taken when the unrestricted pig on the right (No. 1056) weighed 216 lb. At this time its fellow on the left (No. 1059) weighed 176 lb. Figs. 2 and 3 represent the front and back views of the same pair at this time. Fig. 4 represents pig No. 1059 when it had attained 204 lb. The rate of growth of these two pigs, which were a very typical pair, is shown in Fig. 5.

RESULTS.

I.—Age at Bacon Weight and Rate of Gain.

In each case the unrestricted pig reached bacon weight some considerable time before its fellow, the difference varying from seven to forty-nine days, with an average of 27¼ days. It will be noticed (Table I) that the average age at which the unrestricted

Table I.

Pair No.	Unrestricted Pigs.			Restricted Pigs.		
	No. of Pig.	Age at Bacon Weight.	Rate of L.-W. gain per day.	No. of Pig.	Age at Bacon Weight.	Rate of L.-W. gain per day.
		days.	lb.		days.	lb.
I . .	1024	205	1·44	1017	233	1·08
II .	1022	191	1·52	1020	226	1·13
III .	1015	191	1·52	1018	226	1·13
IV .	1031	194	1·47	1033	229	1·16
V . .	1034	208	1·35	1027	229	1·15
VI .	1036	194	1·49	1026	215	1·20
VII .	1032	187	1·60	1028	222	1·15
VIII .	1048	179	1·70	1044	214	1·20
IX .	1040	179	1·69	1050	207	1·25
X .	1045	186	1·68	1051	221	1·18
XI .	1041	186	1·69	1042	207	1·28
XII .	1056	186	1·64	1059	214	1·24
XIII .	1086	190	1·55	1085	203	1·28
XIV .	1080	162	1·91	1078	210	1·27
XV .	1094	186	1·43	1095	213	1·15
XVI .	1055	207	1·38	1064	214	1·26
XVII .	1062	179	1·69	1058	214	1·19
XVIII .	1052	193	1·52	1065	207	1·25
XIX .	1072	197	1·44	1071	217	1·20
XX .	1073	197	1·44	1075	224	1·15
Mean .		189·9	1·55		217·25	1·19

pigs reached bacon weight was 190 days, and the restricted 217¼ days. The average age at slaughter of the bacon pigs of this country is not known, but a live weight of 200 lb. at an age of 200 days is generally considered to be entirely satisfactory. In view of the poor start of all the pigs the time taken by the restricted ones to reach bacon weight (205 lb.) was not excessive.

Similarly it will be seen that the average daily live-weight gain was 1·55 lb. for the unrestricted pigs as opposed to 1·19 lb. for the restricted pigs. Again, even this latter figure would in practice be considered perfectly satisfactory.

II.—Food Consumption.

The results revealed by Table II are striking. In spite of the shorter time taken by the unrestricted pigs to attain bacon weight, their average food consumption was considerably greater than that of the restricted pigs. The average daily consumption of food by the unrestricted pigs was 5·57 lb., with a maximum of 9 lb in one case; the restricted pigs averaged 3·92 lb. per day with a maximum of 5½ lb.

Table II.

	Unrestricted Pigs.					Restricted Pigs.				
Pair No.	No. of Pig.	Food Consumption.	Average food consumption per day.	Food consumption per lb. L.-W. gain.	Food consumption per lb. dead-weight gain.	No. of Pig.	Food Consumption.	Average food consumption per day.	Food consumption per lb. L.-W. gain.	Food consumption per lb. dead-weight gain.
I	1024	683	5·42	3·76	5·17	1017	589	3·82	3·53	5·01
II	1022	573	5·12	3·37	4·57	1020	536	3·65	3·23	4·36
III	1015	591·5	5·28	3·47	4·57	1018	547·5	3·72	3·31	4·43
IV	1031	635	5·33	3·62	5·02	1033	588	3·82	3·29	4·69
V	1034	726	5·46	4·06	5·65	1027	601	3·90	3·40	4·71
VI	1036	636·5	5·35	3·60	4·79	1026	538·5	3·85	3·21	4·29
VII	1032	598	5·34	3·33	4·64	1028	566·5	3·85	3·35	4·39
VIII	1048	580	5·69	3·28	4·51	1044	545·5	3·98	3·31	4·42
IX	1040	570·5	5·59	3·32	4·44	1050	500	3·85	3·09	4·26
X	1045	634	5·82	3·46	4·63	1051	588	4·08	3·47	4·88
XI	1041	621	5·70	3·38	4·69	1042	507	3·90	3·05	4·06
XII	1056	642·5	5·89	3·60	4·87	1059	557	4·07	3·29	4·53
XIII	1086	695·5	5·94	3·84	5·33	1085	524	4·03	3·16	4·31
XIV	1080	466	5·23	2·74	3·90	1078	543	3·96	3·12	4·29
XV	1094	664·5	5·68	3·98	5·42	1095	560	3·89	3·37	4·73
XVI	1055	705·5	5·43	3·92	5·45	1064	548	4·00	3·18	4·37
XVII	1062	592·5	5·81	3·44	4·68	1058	554	4·04	3·39	4·84
XVIII	1052	693	5·97	3·94	5·37	1065	526	4·65	3·25	4·37
XIX	1072	705	5·69	3·94	5·22	1071	573·5	3·98	3·32	4·68
XX	1073	695·5	5·61	3·89	5·17	1075	592·5	3·92	3·41	4·76
Mean		635·5	5·57	3·60	4·91		554·3	3·92	3·28	4·53

The actual average food consumptions of the two groups are shown in Fig. 6.

The unrestricted pigs consumed 3·60 lb. of food per pound of live-weight gain, the restricted 3·28 lb., showing a saving of 0·32 lb. of food per pound of live-weight gain on the part of the latter. It is important to note that the efficiency in the two groups, while being fed similarly up to 65 lb. live weight, did not show this discrepancy; thus the difference may be confidently attributed to the restriction of the quantity fed.

It will be seen that the efficiency of the restricted pigs,

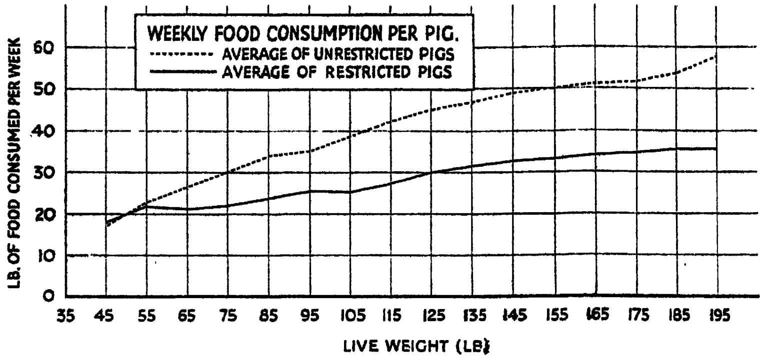


FIG. 6.

reckoned on a live-weight basis, was greater in sixteen out of a total of twenty pairs and, on a dead-weight basis, in eighteen out of twenty. In the exceptional case of pair No. XIV the unrestricted pig No. 1080 was altogether remarkable. He was the first pig to reach bacon weight, which he did in 162 days from birth, twenty-eight days less than the average for his group. His live-weight gain per day through the whole period was remarkable, being 1·91 lb. per day, and this was achieved at the cost of only 2·74 lb. of food per pound of live-weight gain, against an average for his group of 3·60 lb. It was due to the exceptional performance of this pig that, in this case, the positions were reversed.

From time to time these exceptional pigs occur, though it is only when pigs are fed individually that it can be shown that the abnormal gains are due to greater efficiency of food utilization and not to an abnormal food consumption, which in this case never exceeded 7¼ lb. per day.

This is hardly the place to discuss all the interesting questions arising from the behaviour of this animal, nor the physiological considerations underlying it, though they appear to us to be of fundamental importance. To what can be ascribed this abnormal performance? Is it pathological—something accidental—or has it a genetic origin, and is it therefore capable of being reproduced? If this is so, it presents the possibility of developing by selection a strain of pigs of greatly enhanced efficiency. We can only say that the litter brothers of this particular animal, Nos. 1078, 1085 and 1086 appeared merely average, though we realize that this fact does not preclude a genetic basis of the phenomenon.

The efficiency of both groups would be considered satisfactory in commercial herds. The unrestricted pigs, although they required less for maintenance over their shorter life, failed to

make adequate use of the extra food they received, and thus compared unfavourably in ultimate efficiency with the restricted pigs.

The efficiency, worked out on a dead-weight basis, shows similar results, for the percentage of dead weight to fed live weight was practically identical for the unrestricted and restricted groups, being 72·2 and 71·6 per cent. respectively. The unrestricted pigs consumed 4·91 lb. of food per pound gain in carcase weight, and the restricted pigs 4·53 lb. For the purpose of this calculation the initial dead weight was taken arbitrarily as two-thirds of the live weight. As between the sexes there was no significant difference in efficiency.

III.—Grading.

A comparison of the grading of the two groups is no less striking. It will be seen from Table III that only 10 per cent. of the unrestricted pigs were in the bonus grades A and B, as against 55 per cent. of the restricted pigs. There was not a single Grade A pig in the unrestricted group, whereas seven out of the eleven bonus pigs in the restricted group were Grade A.

Table III.

Pair No.	Unrestricted Pigs.				Restricted Pigs.			
	No. of Pig.	Back.	Streak.	Payment.	No. of Pig.	Back.	Streak.	Payment.
I	1024	D	A	D	1017	B	A	B
II	1022	C	A	C	1020	A	A	A
III	1015	D	A	D	1018	C	A	C
IV	1031	B	A	B	1033	A	A	A
V	1034	D	A	D	1027	A	A	A
VI	1036	C	A	C	1026	D	B	D
VII	1032	D	A	D	1028	C	A	C
VIII	1048	D	A	D	1044	B	B	B
IX	1040	D	A	D	1050	A	A	A
X	1045	D	A	D	1051	C	A	C
XI	1041	C	A	C	1042	A	A	A
XII	1056	E	A	E	1059	B	A	B
XIII	1086	D	A	D	1085	E	A	E
XIV	1080	C	A	C	1078	C	A	C
XV	1094	C	B	C	1095	C	A	C
XVI	1055	D	B	D	1064	B	A	B
XVII	1062	D	A	D	1058	D	A	D
XVIII	1052	E	B	E	1065	D	B	D
XIX	1072	B	A	B	1071	A	A	A
XX.	1073	D	A	D	1075	A	A	A

Contrary to expectations, the grading of the streak was as good in the restricted pigs as in the unrestricted group. In each group there were three Grade B streaks, the remainder being Grade A. Further, these Grade B streaks were associated with

the lower grades of back, and thus did not, in any case, influence the final grading, which proved to be entirely dependent upon the back-fat measurements.

The only instances in which the unrestricted pig of a pair graded better than its restricted fellow occurred in the lower grades, which suggests that in these cases the genetic capability of the pig was the limiting factor.

TABLE IV.

Grading.	Unrestricted Pigs.				Restricted Pigs.			
	No. of Pigs.	As % of Total.	No. of Hogs.	No. of Gilts.	No. of Pigs.	As % of Total.	No. of Hogs.	No. of Gilts.
A . .	—	—	—	—	7	35	1	6
B . .	2	10	—	2	4	20	2	2
C . .	5	25	3	2	5	25	4	1
D . .	11	55	6	5	3	15	2	1
E . .	2	10	1	1	1	5	1	—

As Table IV clearly shows, the gilts graded better than the hogs. This is in accordance with general experience.

IV.—Efficiency of Production by Pigs of Different Grades.

On this point the evidence (Table V) is at present insufficient to justify any definite statement, the numbers of each grade being too small. It is hoped that when the experiment is completed it will be possible to make some more definite pronouncement.

TABLE V.

Grading.	Unrestricted Pigs.			Restricted Pigs.		
	No. of Pigs.	Average age in days.	Average Food consumed per lb. live-weight gain.	No. of Pigs.	Average age in days.	Average Food consumed per lb. live-weight gain.
A . .	—	—	—	7	220	3·26
B . .	2	195·5	3·78	4	218·75	3·33
C . .	5	184	3·41	5	218·5	3·34
D . .	11	191·75	3·62	3	212	3·28
E . .	2	189·5	3·77	1	203	3·16

V.—The Financial Aspect.

It has been shown that the restricted pigs were more efficient in food conversion and that they graded better.

The average superiority in efficiency was 0·38 lb. food per pound of carcase, and the average increase in price per score due to the better grading was 0·65 shillings.

Taking a pig of an initial dead weight of 20 lb. (30 lb. live weight) and a final carcase weight of 150 lb., the saving in food will be 49·4 lb., which, if the food is valued at 8*s*. per cwt., represents a saving of 3*s*. 6*d*.

Similarly, the higher price per score of the restricted pigs will result in an increased return of 4*s*. 3*d*. per pig.

The total financial advantage as calculated in this way would be 7*s*. 9*d*. per pig in favour of the restricted pigs. Against this must be set the increased charges for labour and accommodation for the extra time taken by the restricted pig. In the case of the present experiment this time was twenty-seven days.

The authors take this opportunity of acknowledging their indebtedness to Dr. J. Hammond, F.R.S., for his advice in the planning of this experiment, and to Dr. E. H. Callow for the measurement of the carcases at the factory.

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THE DISPOSAL OF SUGAR BEET BY-PRODUCTS.

The Manurial Effects of Sugar-Beet Tops when fed to Sheep and when ploughed in.

In previous issues of this Journal there have been published reports on experiments carried out at the Norfolk Agricultural Station on the disposal of sugar beet by-products. The feeding of sugar-beet tops to fattening cattle (Ref. 1) and to fattening sheep (Ref. 2) has already been discussed. The account of the whole series of experiments is now concluded by the publication of this report, which deals with the manurial value of sugar-beet tops when folded by sheep and when ploughed in.

The trials collectively were carried out to determine the value, in every aspect of farm practice, of sugar-beet tops as a substitute for the usual roots—swedes and mangolds—in the rotation. The assumption (Ref. 2) that the sugar beet crop would in course of time be established as occupying a greater part of the root area than mangold and swedes, on suitably situated farms, has been more than justified, and at the present day it is estimated that over 57 per cent. of the root area in Norfolk is under sugar beet. Until comparatively recent times the maintenance of the condition of much arable land depended largely on the folding of root crops by sheep and on the use of large quantities of farmyard manure. With

the substitution of sugar beet for swedes, the usual folding crop has been replaced by one in which the greater portion is sold directly from the land.

In previous reports it has been shown that the by-products from the sugar beet crop are of great feeding value, and that both the tops and the pulp are excellent substitutes for mangolds and swedes, not only for sheep but also for fattening and other cattle. The object of this report is to indicate the extent to which sugar-beet tops can be relied upon to maintain the condition of the land and, by reference to previous results (Refs. 1 and 2), to permit manurial and feeding values to be compared and, subsequently, to enable a recommendation to be made regarding the best method of disposal in practice.

The Trials of 1930–1933.

A separate trial was started in the early winter of each of the three years 1930, 1931 and 1932. Each trial consisted of two parts, one in which the treatments were carried out early in the winter (November—December) and the other later, viz., at the end of January. By putting down a trial on the same plan in each of three successive years, and by having two times of "sheeping," it was possible to investigate the effects of seasonal influences on the manurial value of the tops, and also to demonstrate the difference, if any existed, between the effects of early and late folding. The trials were put down on the randomized block layout, there being four blocks for each time of "sheeping." The trial which was started in the winter of 1930 differed in one respect from the trials of the following years; it contained only four treatments which were :—(1) tops carted off the land; (2) tops ploughed in; (3) tops sheeped and (4) swedes sheeped. A further treatment, which involved carting off all the tops and applying a complete mixture of artificials, was introduced into the two subsequent trials. The mixture of artificials used consisted of 1 cwt. sulphate of ammonia, 1 cwt. 30% potash salts and 2 cwt. superphosphate per acre. The object of this additional treatment was to enable a direct comparison to be made between the manurial effects of beet tops and a mixture of artificials that might be substituted for them in practice—a comparison that was desirable if beet tops should ultimately be proved to be best utilized for cattle feeding. The composition of the mixture was based on barley manurial trials made at Sprowston and reported in a previous issue of this Journal (Ref. 3).

The trials have been carried out on a light loam soil overlying brick earth, on very typical beet-growing land. The

measurement of the manurial value of the tops was made by taking the yields of successive crops in a rotation of (1) barley, (2) hay, (3) wheat and (4) sugar beet.

Although the sheep-folds varied in size from year to year, the amounts of tops and swedes fed each year were of equivalent feeding value. The actual rates of sheeping are given in the following table :—

RATES OF SHEEPING—TONS PER ACRE.

Treatment.	Experiment. 1930.	1931.	1932.	Mean.
Sheeped swedes	9·6	9·8	14·4	11·3
Sheeped tops	9·2	8·0	9·3	8·8
Tops ploughed in	9·2	8·2	9·3	8·9

In the 1931 and 1932 trials, the small quantity of food residues from the sheep-folding were spread on the folds, thus imitating farm practice. The food residues of the 1930 trial, however, were not returned to the folds. This slight difference in practice did not affect the comparative yields, as will be observed later. All cake and meal were omitted from the rations of the sheep for at least forty-eight hours before they went on to the plots, in order to ensure, as far as possible, that the manures deposited on the plots consisted entirely of the residues of the swedes or sugar-beet tops. Hay was also fed, and contributed to the residues. The sheep were on each appropriate plot for forty-eight hours; since only one plot could be folded at a time it was considered that a longer folding period might introduce complications due to changing weather conditions. For the same reason the number of repetitions of each treatment, at one time of sheeping, was limited to four.

Summary of Results. The plots were harvested separately and in the following table the mean yields resulting from the various treatments are given. The difference between the effects of the two times of folding was very slight, and in the discussion the early and late folding sections of the experiments have been combined. This in no way affects the general conclusions because there was no difference in the comparative results from the early and late sections. The mean yields for the treatments are the average of the crops in three rotations, except that for artificials, which is the average for two rotations only.

Clearly defined increases due to the manures were obtained in the barley crop, but in the second (hay) crop responses were evident only to the manurial residues of the sugar-beet tops. The action of the artificials was confined to the barley crop and did not influence the hay and wheat yields.

MEAN YIELD PER ACRE OF GRAIN, STRAW AND HAY OF CROPS IN THREE ROTATIONS.

Treatment.	Barley bus.	Barley straw cwt.	Hay (dry matter) cwt.	Wheat bus.	Wheat straw cwt.
Sheeped swedes	46·2	23·9	38·3	37·9	21·5
Sheeped tops	48·0	25·5	41·0	38·1	20·4
Tops ploughed in	47·2	25·7	42·5	36·4	20·6
Tops carted off	38·9	18·9	37·8	36·7	20·5
Tops carted off plus artificials[1]	48·5	26·4	31·7	32·7	17·5
Increase due to :—					
Sheeped swedes	7·3	5·0	Nil[2]	Nil[2]	Nil[2]
Sheeped tops	9·1	6·6	3·2	Nil	Nil
Tops ploughed in	8·3	6·8	4·7	Nil	Nil
Tops carted off plus artificials[1]	9·3	6·9	Nil	Nil	Nil

[1] Average of two years' results only.
[2] "Nil" implies that the increase or decrease was not significant.

The Barley Crop.

(a) *Yields of Grain and Straw.*

Observations on the growth and appearance of the barley crop were made from the time of brairding until harvest. Germination was uniform, but three weeks afterwards differences were clearly discernible. The unmanured plots were paler in colour and less vigorous than the manured plots, of which the "tops ploughed in" plots and the "artificials" plots were the deepest green. The sheeped plots were always less impressive than the others, especially in the early stages, and although these sheeping effects were not continued to harvest, the indications of lack of manure on the control plots were plainly evident at all times. In the 1930 and 1931 trials lodging was most severe on the manured plots, the artificials plots in the 1931 trial being laid more than any of the others. Practically no lodging occurred on the control plots. There was very little lodging in the 1932 trial.

YIELDS OF BARLEY GRAIN—(BUSHELS PER ACRE).

Treatment.	Experiment.			Mean. 1930, 1931, 1932.	Mean. 1931, 1932.
	1930.	1931.	1932.		
Sheeped swedes	46·8	44·5	47·2	46·2	45·8
Sheeped tops	48·1	46·9	49·1	48·0	48·0
Tops ploughed in	50·6	46·1	44·9	47·2	45·5
Tops carted off	38·2	40·3	38·2	38·9	39·2
Tops carted off plus artificials	—	49·9	47·1	—	48·5
Mean	45·9	45·5	45·3	45·1	45·4
Standard Error	1·0	0·6	1·0	—	—

YIELDS OF BARLEY STRAW.—(CWT. PER ACRE.)

Treatment.	Experiment. 1930.	1931.	1932.	Mean. 1930, 1931, 1932.	Mean. 1931, 1932.
Sheeped swedes	23·0	23·3	25·3	23·9	24·3
Sheeped tops	25·5	26·0	25·0	25·5	25·5
Tops ploughed in	30·5	25·7	20·8	25·7	23·2
Tops carted off	17·5	20·8	18·3	18·9	19·5
Tops carted off plus artificials	—	30·1	22·7	—	26·4
Mean	24·1	25·2	22·4	23·5	23·8
Standard error	—	0·8	0·8	—	—

In all three years the control plots have given the smallest yields of barley grain. There was very little difference between the effect of sheeping and that of ploughing in the beet tops. Only in one year, namely 1932, was there a significant difference between the two methods, when sheeping the tops gave an increase of 4·2 bushels per acre over ploughing in the tops. On the average the manurial effect of 8·9 tons of beet tops was to increase the yield of barley grain by 8·7 bushels per acre. There was a tendency for the barley grain yields to be lower where swedes were sheeped than where sugar-beet tops were either folded or ploughed in. Ploughing in the tops in the 1930 trial, and folding the tops in the 1931 trial, gave higher yields than the folding of the swedes. In the 1931 trial the " artificials " plots outyielded all the others and gave an increased yield, over the control, of 9·6 bushels per acre. In the 1932 trial, however, the " artificials " plots were no better than the other manured plots.

Owing to the very wet harvest and the severe lodging of the barley, the straw yields in the 1930 trial could not be subjected to a statistical analysis, and therefore any conclusion drawn from the straw yields of the 1930 trial must be of a tentative nature. The 1931 and 1932 trials show that, on the average, the effect of ploughing in sugar-beet tops, or of folding them off with sheep, has been to increase the yield of barley straw by 4·8 cwt. per acre. Owing to inconsistencies in the results, it is impossible definitely to state the relative efficiency of sheeped swedes and beet tops, either sheeped or ploughed in; but the average yields from these three treatments in the 1931 and 1932 trials are almost identical. Carting the beet tops off and applying a mixture of artificials gave 7 cwt. per acre more barley straw than the yield of the control plots.

(b) *Quality.*

Nitrogen determinations were done on the barley grain from the various treatments. The nitrogen contents given in the

accompanying table are taken as a measure of the quality of the barley.

AVERAGE PERCENTAGE OF NITROGEN IN THE BARLEY GRAIN.

Treatment.	Experiment. 1930.	1931.	1932.	Mean. 1930, 1931, 1932.	Mean. 1931, 1932.
Sheeped swedes	1·54	1·61	1·22	1·46	1·41
Sheeped tops	1·50	1·67	1·24	1·47	1·45
Tops ploughed in	1·58	1·67	1·22	1·22	1·44
Tops carted off	1·44	1·60	1·19	1·19	1·39
Tops carted off plus artificials	—	1·60	1·13	—	1·36
Mean	1·51	1·63	1·20	—	—

It is difficult to draw conclusions from these figures, because the differences are so small; but it is obvious that the quality of the barley was not impaired by any of the treatments and that all the samples were of good malting quality.

The Hay Crop.

The small seeds, consisting of a mixture of perennial ryegrass and clover, were sown under the previous barley crop. Except in the 1931 experiment, when the barley was badly laid, a satisfactory sward was obtained and no difficulty was experienced in securing good hay yields. In the following table the hay yields are given in terms of dry matter per acre.

YIELDS OF HAY—DRY MATTER (CWT. PER ACRE.)

Treatment.	Experiment. 1930.	1931.	1932.	Mean. 1930, 1931, 1932.	Mean. 1930, 1932.	Mean. 1931, 1932.
Sheeped swedes	45·0	26·5	43·5	38·3	44·2	35·0
Sheeped tops	50·0	28·6	44·4	41·0	47·2	36·5
Topsploughedin	51·6	26·8	49·2	42·5	50·4	38·0
Tops carted off	44·1	25·8	43·4	37·8	43·7	34·6
Tops carted off plus artificials	—	22·8	40·6	—	—	31·7
Mean	47·7	26·1	44·2	39·9	46·4	35·2
Standard error	1·7	1·5	1·1	—	—	—

There are very few significant differences in the hay yields. In the 1930 and 1931 trials, sheeping the tops gave as high hay yields as ploughing in the tops, but in the 1932 trial the "sheeped tops" plots gave a significantly lower yield than the "tops ploughed in" plots. If the 1931 trial be neglected on account of the poor yields, consequent on the severe lodging of the preceding barley, it is found that ploughing in the tops increased

the yield of hay by 6·7 cwt. of dry matter per acre. There was no significant increase on the "sheeped swedes" plots in any of the trials. The yields of the "artificials" plots did not differ from the yields of the control plots. On the average the manurial effect of 8·9 tons of beet tops was to increase the hay crop, two years later, by 4 cwt. of dry matter per acre.

THE WHEAT CROP.

Following the usual farm practice at Sprowston, the clover ley was ploughed, about 3 in. deep, immediately after the hay had been carted off, and the land was cultivated frequently to kill the seeds. The plots received no farmyard manure, and no nitrogenous top-dressing was given in the spring. In the 1930 and 1931 trials average yields of wheat were obtained, but in the third trial the wheat crop was very poor and all plots would have benefited from a spring application of nitrogenous manure. The yields of grain and straw are given in the following tables :—

YIELD OF WHEAT GRAIN—(BUSHELS PER ACRE).

Treatment.	1930.	1931.	1932.	Mean. 1930, 1931, 1932.	Mean. 1931, 1932.
Sheeped swedes . .	44·5	41·0	28·3	37·9	34·6
Sheeped tops . .	47·4	39·8	27·1	38·1	33·4
Tops ploughed in . .	41·4	38·6	29·3	36·4	33·9
Tops carted off . .	43·7	37·6	28·7	36·7	33·1
Tops carted off plus artificials . .	—	38·4	27·0	—	32·7
Mean . . .	44·2	39·1	28·1	37·3	33·5

YIELD OF WHEAT STRAW—(CWT. PER ACRE).

Treatment.	1930.	1931.	1932.	Mean. 1930, 1931, 1932.	Mean. 1931, 1932.
Sheeped swedes . .	25·6	23·4	15·6	21·5	19·5
Sheeped tops . .	24·4	22·8	14·0	20·4	18·4
Tops ploughed in . .	24·1	23·1	14·6	20·6	18·8
Tops carted off . .	26·2	20·8	14·6	20·5	17·7
Tops carted off plus artificials . .	—	22·2	12·8	—	17·5
Mean . . .	25·1	22·5	14·3	20·7	18·4

Except in the 1930 trial, there were no marked differences between the various treatments. In the first trial, sheeping the tops gave a higher yield of wheat grain than ploughing the tops in, but this was the only year when such a result was obtained. There were no significant differences between the

wheat straw yields in any of the trials. Clearly, therefore, the beet tops in these trials have not affected either the yield of grain or straw in the third crop (wheat) in the rotation after sugar beet. Neither does it seem possible to influence the persistency of the manurial effects of beet tops by varying the method of their disposal.

Comments. In these trials, the whole of the tops grown in one year were utilized, as is no uncommon occurrence in farming practice. Difficulties, however, may arise when sheeping or ploughing in the whole crop, especially if the following crop is barley in a district which produces good malting samples. Lodging and a high nitrogen-content are only too easy to induce on good land, and it is obviously the best policy to vary the quantity of tops folded or ploughed in, according to the nature and condition of the land. At Sprowston, for instance, it is usual to cart half the beet tops off the land : at other places more or less (as may be determined by experience) may be sheeped or ploughed in without causing lodging or impairing the quality of the barley. In any case the beet tops must be evenly spread before they are either folded or ploughed in.

In practice the tops may be disposed of at any time from early October to February and in exceptional years even as late as the end of February. Obviously all the beet tops cannot be disposed of before Christmas, but in the case of tops for ploughing in, the ploughing should be done as early as possible, in order that decomposition of the tops may be well advanced by the time spring sowing takes place. This is particularly important in areas where good malting barley can be grown.

It was not possible to determine the speed at which the manurial ingredients of the beet tops become available, but it seems unlikely that they do so quickly. It is probable that the colder weather of the winter months slows down the rate at which the beet tops decompose, and that the interval between ploughing in the tops and drilling the succeeding crop should be as long as possible, in order to enable full decomposition to take place. Thus whenever possible the prudent husbandman will drill barley (or whatever may be the next cereal after beet) early in the year and arrange that the beet tops have been ploughed in or sheeped in ample time for a full supply of plant foods to be ready for the early stages of the growth of the cereal.

It is not safe to argue that, because the artificials at a cost of 25*s.* per acre produced as much barley as roughly nine tons of beet tops, one ton of tops is worth about 2*s.* 9*d.* as manure, for there is no evidence from the trials that the barley responded to all of the three ingredients in the artificial mixture. Nor would it be correct to say that the effects of the artificials would always be seen for only one year, although it was so, to

all intents and purposes, in the two dry years when the "artificials" plot was included in the trials. Previous work at Sprowston has shown conclusively that barley, after roots carted off the land, responds to phosphates as well as to nitrogen, and that the effects of a complete mixture of artificials are evident on the hay crop, especially those due to potash manuring. Care, therefore, must be taken not to make specific comparisons, particularly monetary valuations, between the results of the artificial and beet-top manuring in these trials.

The results of the "artificials" plots are useful only because they demonstrate that beet tops may be carted off and equivalent results obtained, at least on the next crop in the rotation, by using an appropriate mixture of artificial manures. Beyond that it is not safe to go.

The results, however, do most clearly show that beet tops are a valuable green manure, that they are as valuable as swedes in their manurial effects for folding with sheep, and that when used at about 9 tons per acre they may be expected to increase the yields of the next two crops in the rotation; each ton of tops producing per acre, one extra bushel of barley, $\frac{3}{4}$ cwt. more barley straw and $\frac{1}{2}$ cwt. more hay. Obviously the cash value of the tops as manure depends upon the value of the extra barley, straw, and hay, which varies from year to year. Beet tops, moreover, must exert some physical effect on the soil by the humus which they add; and they are definitely a most valuable means of assisting to maintain the condition of arable holdings.

Summary.

1. A series of experiments, designed to measure the manurial value of sugar-beet tops when fed to sheep and when ploughed in, has been described. The manurial value of the tops was compared with the manurial value of an equivalent quantity of swedes and also with a mixture of artificials. The method adopted to measure the manurial value was to determine the yields of the crops in the rotation following the sugar beet crop. The rotation practised was sugar beet, barley, hay and wheat.

2. Sugar-beet tops, whether ploughed in or sheeped were as efficient as sheeped swedes in producing good yields of barley grain. The yield of straw however, tended to be greater after sheeped swedes than after sugar-beet tops. Four cwt. per acre of a mixture of artificials (1 cwt. sulphate of ammonia, 2 cwt. superphosphate, and 1 cwt. potash salts) tended to give higher yields of barley grain and straw than the organic forms—sheeped swedes, and sugar beet tops, ploughed in or sheeped.

3. The hay yields after sheeped swedes and sheeped tops

were identical. The artificials applied to the barley crop had very little effect on the yield of hay.

4. The effects of the manurial treatments on the wheat crop, the third crop after sheeping, were negligible and in none of the three trials did the treatments give higher yields than the control plots which received no manuring.

5. The effects of ploughing in or sheeping the tops persisted for two years after the beet crop, *i.e.*, on the barley and hay crops. It did not influence the yield of the next crop (wheat) in the rotation.

6. The value of beet tops as manure varies with the market value of the increased yields of the succeeding crops, but omitting any monetary valuation, 1 ton of fresh tops as manure gave one bushel per acre more barley grain, $\frac{3}{4}$ cwt. per acre more barley straw and $\frac{1}{2}$ cwt. per acre more hay.

7. Yield increases in the first crop of the rotation equivalent to those from the beet tops, were obtained from artificial manures costing approximately 25*s*. per acre at current (1934) prices.

8. There was no difference in the effects of ploughing in or sheeping the tops. Thus it is possible to utilize the tops as sheep feed and still obtain the equivalent of their manurial value when ploughed in fresh.

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THE FARMER'S GUIDE TO AGRICULTURAL RESEARCH IN 1934.

For the past ten years the Royal Agricultural Society of England has issued annual summaries of Agricultural Research, as carried on in its leading branches, prepared under the direction of the Research Committee of the Society. The publication, originally issued under the title of *Agricultural Research*, is now known as *The Farmer's Guide to Agricultural Research*, for this describes the main purpose with which the Society undertook the work, namely, to spread the lessons of research among those to whom they are likely to be of greatest use by giving the farmer information on the results of the year's work of the experimental stations in a summarized and simple form.

The survey of scientific work which it provides is not limited to research conducted in the British Isles, but includes references to the results achieved in any part of the world from which light may be thrown on the problems of British agriculture.

As last year, *The Farmer's Guide* forms a section of the Society's *Journal* so that it may be in the hands of every member of the Society. At the same time a number of copies are being bound separately for private circulation only, and distribution to the Press and to centres of Agricultural Education and Research.

The Authors responsible for the various sections are the same as those who contributed to the issue of the previous year.

A few copies of previous issues (for the years 1925-1933) are still available.

CROPS AND PLANT BREEDING.

A.—GRASSLAND.

I.—INTRODUCTION.

IT is not intended in this account to discuss all aspects of recent grassland research, but the subject-matter will be restricted to work which is directly concerned with the improvement of grassland by controlling the botanical composition of the herbage. The production and utilization of improved species and strains of plants is obviously the basis of any progressive system of grassland improvement, but all aspects of management and farming policy have also to be considered in so far as they affect the botanical composition. The importance of the management factor is, in fact, rapidly being recognized as a much neglected aspect of all grassland improvement.

During the last few years a gradually developing grassland research has reached the stage when there is a definite and

directed policy common to most countries who have grassland interests. In Europe, the American continent, New Zealand, Australia, and South Africa, there has been a development of a new "grass consciousness" which is rapidly having a far-reaching effect on the world's grassland. For this country the most important work is being done at Aberystwyth, where the breeding of herbage plants and the improvement of grassland is the principal work of the Welsh Plant Breeding Station. A great deal of work on grassland management is also being carried out in many other parts of the country, but the details of this work cannot be entered into here. For the most part the grassland problems receiving attention in regional experiment stations have a local interest only, but some of the work has a wider application, and where possible it will be mentioned. Every country and local area has its particular problems, but there is a general trend in the research which is common to all. For brief general accounts of the scope of the grassland research work in this and other countries the reader is advised to consult Refs. 1 and 2.

The object of all grassland research is, of course, to improve the yield and the quality of the herbage from all types of grassland. It is common knowledge now that grass can be made one of the cheapest sources of food for cattle, sheep, and horses. Nutritional experiments have shown that well-managed young grass has a feeding value equal to that of certain concentrates. But grass is a most unreliable source of food upon which to be wholly dependent. It is subject to the vicissitudes of the weather to an abnormally high degree, and even under equable growing conditions its rate and quality of growth vary during any one growing season, and from season to season. Grass is definitely seasonal, and the period during which it remains productive is comparatively short; therefore it is essential to find some means of conserving young grass for winter feeding to overcome this seasonal disadvantage.

Grassland research has among its aims the elimination of these undesirable factors. The first step is obviously the study and understanding of the plant in relation to its environment. This study is called *ecology*, and ecological considerations are fundamental to all grassland improvement. This is so because the most productive grassland can be grown only where the most desirable and valuable herbage species are best suited to their environment. Conversely, the best can only be obtained from any set of environmental conditions if the species or strains which grow most successfully under these conditions are cultivated. Therefore, before anything else is attempted in the way of grassland improvement, the botanical composition of the herbage should command attention and every effort made to secure the

growth of the best suited and most valuable strains of herbage plants.

Herbage plant species are characterized by such great variability that any one species possesses growth forms which have been evolved in response to particular sets of conditions. There is little doubt that every locality has its own particular growth form or strain which grows more successfully than any other growth form from another locality. The production of improved strains thus becomes a local problem which is of direct concern to every farmer who grows grass. It is for this reason that some account is given here of methods of breeding herbage plants. The time may come when every farmer will participate in the local improvement of herbage species, because work conducted at a few isolated centres has only a limited application. This is obviously true in the case of indigenous strains, which cannot be employed haphazard under any set of environmental conditions if the full benefit is to be obtained from them.

In 1934 the total grassland acreage was approximately two and one half times the total acreage of arable land. There is continued apprehension among many people at the ever increasing proportion of grassland in the total agricultural acreage, because it is often said that there can be a thriving agriculture only if there is a certain percentage of the land under the plough. One of the reasons for this statement is that arable farming is generally supposed to employ more men per acre than grassland farming, and therefore any increase in grassland means rural unemployment. This is not necessarily true, because so much depends on the type of grassland which takes the place of the arable. If it is rough grazing and neglected, outrun pastures, then agriculture as a whole will suffer through unemployment and unproductiveness; but if productive grassland develops at the expense of unproductive arable, then agriculture stands to gain. It has been shown that in the Eastern Counties the size of the farm has a much greater effect on the number of men employed per acre than has the type of farming practised (Ref. 3).

II.—The Improvement of Herbage Plants.

The task of improving the forms of herbage plants available to farmers in England and Wales was undertaken by the Aberystwyth Station in 1919. Much organizing and pioneer work had to be done, but in 1934 new and improved strains were put on the market through several Seed Houses. In a general account of the work accomplished at this station and elsewhere, details of breeding technique will not be discussed, but emphasis will be laid on the practical applications which would enable many farmers to start local improvements. It cannot be emphasized

too strongly that the improvement of herbage plants is a matter for local undertakings.

(a) *The Significance of Place of Origin : Local Races.*

In the 1931 issue of this publication, Stapledon referred to the selection of stocks and indigenous strains (Ref. 4). Recent work has amplified the significance of the primary selections in any scheme of herbage plant improvement. In this country the important grassland areas have been searched for indigenous plants of marked leafiness and persistence, because such indigenous plants have proved to be the most satisfactory bases for the building up of improved strains by selection and hybridization. Every country occupied with herbage-plant improvement is engaged upon this exploitation of native or indigenous strains, and it is generally recognized as the first step in the development of improved forms.

There is, however, a danger of the conception of indigenous strains suffering from misinterpretation and wrongful application. In the literal sense of the term, an indigenous strain is one that is proper only to its own particular habitat and as such will thrive to the full only under the conditions of this habitat. When an indigenous strain is removed to an environment different from its original one it generally loses, to a large degree, those characters which make it valuable. In other words, because a strain is described as "indigenous" it will not necessarily display superior qualities wherever it happens to be grown. The range of conditions for the successful and superior growth of indigenous strains is strictly limited, and it should be remembered that the place of origin of the strain is the all-important consideration. Thus, indigenous strains developed in this country are superior, here, to New Zealand indigenous strains, although some of these latter, such as Akaroa cocksfoot and Hawke's Bay ryegrass do well in parts of England and Wales. Continental indigenous strains are distinctly inferior to the New Zealand strains when grown in this country, and cannot compare with our own strains.

The same argument is applicable to "pedigree" strains when the term is used to convey the impression of superiority. Certain continental pedigree strains are not as valuable as the New Zealand non-pedigree strains, or the non-pedigree strains raised in this country. This is important because much foreign seed, which is very inferior to our home-produced seed, is sold in this country. The indiscriminate use of indigenous or pedigree strains without due regard to their place of origin is a policy which completely ignores the whole significance of strain in the improvement of grassland. The place of origin of an indigenous strain, and the particular growth type that has been developed by the selector, will determine its successful environmental range and

its agricultural use. Just as no variety of wheat or other crop plant possesses the power to thrive equally well under all conditions, so no pedigree or indigenous strain of herbage plant has a universal application.

(b) *Selection of Plant Initials for Strain Building.*

The basis of all herbage-plant improvement is thus the collection of what may be termed local races, or plant types from particular grassland areas. These local races are selected as single plants from representative pieces of turf, and may be collected either in the vegetative state or else as flowering heads. The selector has then to keep the plants under constant observation for two seasons, in order to study their behaviour throughout the various phases of growth. For the most part he has to rely on his eye judgment in the selection of superior strains, which are chosen largely on individual merit in relation to the type he is endeavouring to create. It may be possible to eliminate certain plants on obvious characters such as male-sterility, growth rate, or vigour, but there is always left a large number of plants which will have to be tested further for desirable agricultural characters (Ref. 6).

The place of origin of the parent plants has to be carefully considered in relation to this selection work. If the plants come originally from an environment which is not stabilized, such as a piece of waste ground, then they have to be treated with considerable care. The reason for this is that plants which are growing in a stabilized environment, or habitat, are most probably all of one type and reasonably stable, but a population from an unstable habitat is most likely to be in an unstable state itself. Nevertheless, examination of material from many localities leaves little doubt that there is a strong relationship between the plant type and the place of origin. This, of course, assumes that there is some form of selection in operation which is affecting the population from generation to generation; a selection which may be environmental or due to man's interference. The following table shows the affect of the place of origin of cocksfoot on the percentage of hay, intermediate, and pasture types, in the population (Ref. 7).

	Hay Types.	Intermediate Types.	Pasture Types.	Percentage contribution as to date of flowering. Early.	Late.
Danish	66	31	3	93	7
New Zealand	33	43	29	60	40
English Old Pasture	12	26	62	36	64

The occurrence of these local races of grasses and clovers means that the task of collecting material for initial selections is of the utmost importance and significance. All such local or regional races contain a greater or lesser proportion of undesirable types, and because all grasses and clovers are cross-fertile, deterioration is probable when seed is taken. The amount of deterioration will, of course, depend on the nature of the population at the outset, while it also varies with the different species. Thus cocksfoot, which shows a restricted range of variability, is subject to little deterioration, as also is wild white clover. Indigenous perennial ryegrass, on the other hand, may show great deterioration even when taken from genuine old pastures.

(c) *Fertility and Sterility.*

It is generally assumed that grass and clover species are cross-fertile—*i.e.*, that pollen must be transferred from one plant to another in order that seed may be set. This is not strictly true, because it is possible to isolate from any one species strains varying from almost complete self-fertility to almost complete self-sterility. It is probable, however, that the average self-fertility varies from species to species (Ref. 6). Investigations at Aberystwyth have shown that practically all annual species of grasses and clovers are highly self-fertile, most of them being completely so, while the perennial species are for the most part cross-fertile, although they show varying degrees of self-fertility. Thus cocksfoot, crested dogstail and timothy appear to be less dependent on cross-fertilization than perennial ryegrass (Refs. 7 and 8).

The degree of self- and cross-fertility is important because it affects the breeding technique, while it also has to be considered in connection with the vigour of the stocks. In-breeding generally leads to loss of vigour, but the degree to which this occurs varies with the species. For example, perennial ryegrass and timothy are subject to great loss of vigour by in-breeding, while cocksfoot and sweet vernal grass are little affected. This means that perennial ryegrass cannot be subjected to single-plant selection without a serious loss of vigour, which has been estimated on the average to be over 50 per cent. when plants are self-pollinated (Ref. 6). Cocksfoot and sweet vernal grass on the other hand can be "pure-lined" (*i.e.*, developed by selection of single plants) with no adverse effects. Another point of importance in relation to vigour is that it may be due to hereditary instability or *heterozygosity*. Plants which are "heterozygous" will not breed true, and when vigour is due to this hereditary state, in-breeding will result in a loss of vigour. Initial selections of herbage plants are often made largely on vegetative vigour, and it may be seen that where this is practised from generation to generation it

will be impossible to reach anything approaching hereditary stability or *homozygosity*. The extent to which homozygosity is necessary or even desirable will be discussed later, but it is a matter of the first importance to the breeder to know whether the material with which he is working is homozygous or heterozygous.

(d) *Strain Building.*

There are two main types of herbage-plant strains—the single-plant strain and the multiple-plant strain. Considerations of fertility, vigour and variability influence the breeder's choice in favour of the one or the other. Thus in the single-plant strain, where one plant is selected as the strain initial, a reasonably high degree of self-fertility is necessary. The progeny of this plant must also possess some self-fertility, or else the plants must be inter-fertile among themselves or with the mother plant. Where there is no great loss of vigour due to selfing, a single plant may be selected and self-pollinated, the resultant plants being broken up and sown with the vegetative offspring of the mother plant. The seed from these plants is mass-selected, and an unstable hereditary type is evolved which is superior to the original stock from which it was selected.

In the multiple-plant strain more than one plant is taken as the strain basis, so that loss of vigour due to in-breeding is not the danger that it is in single-plant strains. The important consideration in this multiple-plant strain is the initial variability, because the greater the number of plant initials and the more unstable their habitats, the greater will be the variability and divergence from the original type in subsequent generations. Thus "in selection work the origin of the plant is of surpassing importance, and selection should not be on absolute characteristics, but more particularly in relation to the general type occupying a particular habitat" (Jenkin, Ref. 6). With regard to self-fertility in multiple-plant strains it should be noted that it is often desirable to have highly self-sterile plants producing large quantities of pollen, in order to ensure a high percentage of cross-pollination.

In this technique of plant improvement no great stress is laid on the genetical purity, which is the main consideration in the improvement of self-pollinated crops such as wheat, barley, and oats. In these cereals the basis of selection is the single and (as far as can be judged) pure-breeding individual, which is the starting point of the "pure line" cultures from which improved varieties are selected. Such genetical purity is not necessary in herbage plants, and may even be undesirable in strains for sward purposes where one plant type is inferior to a mixture. "A certain range of variability, provided the range is within a

prescribed range of excellencies, may be an actual advantage, having regard to such considerations as seasonal growth and the varied needs of the grazier" (Stapledon, Ref. 6). Genetical purity is, however, of importance in the prevention of the deterioration of stocks when seed is produced, because seed production involves cross-pollination and consequent mixing of the types.

This conception of "relative purity" is of the utmost importance because it means that improved strains can be made available to the farmer without the breeder's having to go to the great extra trouble and expense necessary to achieve absolute purity. There is a considerable difference in the time required to achieve 70 per cent. purity as compared with 100 per cent. purity. If, however, the 70 per cent. purity means a strain superior to any being used, it is good policy and economics to be satisfied with the 70 per cent. until a further improvement can be made.

It should be emphasized that in building up strains of grasses there is a great range in the degree of refinement in the technique employed with the different species. At one extreme there is the genetic approach and the single-plant technique for the ryegrasses, while at the other extreme there is the building up of "aggregate strains" in cocksfoot. The latter method is plant improvement at its simplest, being merely a matter of the selection of plant bulks to form the nucleus of an improved strain. The general application of the pure-line method to seed production on a commercial scale is a doubtful proposition in a crop that is normally cross-pollinated, even though it possesses a reasonably high degree of self-fertility. Therefore it seems probable that grasses will never require the technical refinements in breeding technique that are employed in connection with cereals.

Red clover is much like the grasses in being a very variable species consisting of races and types characteristic of the country in which the species is growing. Every named variety is also a mixture of types which differ in characters such as yield, earliness, hardiness, permanence, etc. It is a simple matter to isolate distinct types differing in these characters, and if the species were self-fertile there would be no difficulty in building up improved single-plant strains. A high degree of self-sterility is, however, characteristic, although it is possible to isolate plants which are reasonably self-fertile. Apparently the chances of breeding improved strains by self-fertilization are very small, because the percentage of outstanding plants in any population is so small (1—2 per cent.), and there is very little likelihood that these plants would be self-fertile (Williams, Ref. 6).

Primary selections of plants for strain building are made from the best named varieties, and the basis of selection is

general performance throughout the season. If strains for short leys are desired, then selection is made at the end of the second year; if long-duration strains are desired, the selection is deferred until the end of the third or fourth year. Truly permanent strains are taken from old fields which have been kept closely grazed or cut for hay, and seed is procured from the selected plants by cross-pollination with humble bees in greenhouses. The extreme hereditary variability of red clover makes cross-pollination a great gamble, and generally not more than 5 per cent. of the plants resulting from any crossing are worth a further trial. Nevertheless the selected plants are used as the starting point for building up new strains by different schemes of crossing. Brother-and-sister mating may be tried as being the next best thing to self-pollination for attaining a certain amount of hereditary stability in the more obvious characters, but this form of in-breeding leads to such a great loss of vigour that after four or five generations the best plants from the most promising families have to be cross-pollinated in order to restore the vigour.

White clover differs from red clover in being considerably more self-fertile, but the plants are for the most part completely self-incompatible, so that in the normal course of events no seed is set by self-pollination. The general procedure for breeding improved strains is very similar to that employed for red clover. White clover is also characteristic in that forms collected from old pastures throughout Great Britain have proved to be more or less of the same type, which may be characterized by a form like Kentish Wild White. These forms do, however, possess local races which differ in such characters as productiveness, density of growth, rate of spreading, size of leaf, and cyanophoric reaction.[1] This last character is of importance because it seems probable that cyanophoric plants are less palatable than non-cyanophoric.

(e) *Controlled Pollination and Hybridization.*

In the description of herbage-plant improvement given above, only a passing reference has been made to controlled pollination and hybridization. There are two reasons for this. First, the collection of local races and the selection of improved strains within these races is undoubtedly the most important aspect of the work, and it is a method of improvement which has far-reaching possibilities and infinite scope. Also it is a procedure which may be widely practised without any elaborate lay-out in experimental apparatus, and it has been suggested that it lies within the power of the farmer to conduct such work himself. The second reason is that any adequate description of pollination

[1] A chemical test for measuring the prussic-acid-yielding properties of the plant.

and hybridization technique would be very lengthy and would involve technical considerations which concern the plant-breeder rather than the agriculturist.

It should be realized, however, that controlled pollination and hybridization are necessary in the more refined methods of improvement of some species, and the technique involved varies with the aim in view and the species being studied (Refs. 6 and 7). In its simplest form controlled pollination merely involves the growing of selected plants in greenhouses so that inter-pollination may take place or, alternatively, the isolation of plants in order that they may be self-pollinated. Where groups of plants are taken, the seed is collected and a population of plants is grown therefrom to test its conformity to the original desired type. This procedure is usually repeated to ensure conformity, but in this method of controlled pollination no attempt is made to control the pollination relationship of the individuals in the population, but they are allowed to pollinate at random among themselves. A further improvement of the population may be brought about by "type concentration," in which typical plants are self-pollinated and the progeny tested for uniformity to type. If the progeny is sufficiently uniform the mother plant may be selected, or alternatively the progeny plants can be isolated as a group.

Hybridization between selected plants requires more time, labour and refinement of technique than the controlled pollination described above, but again the procedure adopted will depend on the species involved. For example, the grasses require to be emasculated before hybridization, while the clovers do not, and various methods are used for bringing about successful pollination. The plants chosen for hybridization may be united according to different schemes varying with the species and the circumstances. Thus they may be pollinated in pairs; they may be "chain-pollinated," a system in which every plant is crossed with two other plants according to the following scheme: $1 \times 2 \times 3 \times 4 \times 1$; or they may be so pollinated that every possible combination is tried. This last method has a special application in species which have low self-fertility, because it is the only means of testing potential parents satisfactorily.

(f) *Seed Production.*

An improved strain, after undergoing field trials, has to be multiplied up to produce seed in sufficient quantities for distribution to farmers. The problem of successful seed-production is, for two reasons, a very real one. First, contamination with alien strains, which is always a danger with cross-fertile plants, must be prevented. An effort is always made to start

with as large an area as possible, because the risk of contamination is always greatest when the area for seed production is small. Isolation of the areas is necessary up to a point, but one of the greatest safeguards against alien pollen is to ensure that all the plants in the isolation area will be at the zenith of their flowering at the same time. If this period of maximum flowering does not coincide with the flowering of other strains of the same species, then the risk of contamination is reduced still further (Ref. 7).

The second consideration which must be kept constantly in mind is the cost of the seed to the farmer. This, of course, will depend on the cost of raising the seed by the station involved, which again depends largely on the yield of seed obtained during the period of multiplication. In connection with this, it has been found at Aberystwyth that nitrogen increases the seed yield of cocksfoot, timothy and meadow foxtail by increasing the number of inflorescence-bearing shoots in the leafy strains. Red fescue and meadow fescue, on the other hand, give reduced yields of seed with increased nitrogen. The management of the crop, including such factors as the time and the method of sowing and the system of grazing, also affects the yields of the species in characteristic ways. All these points are important because it has been found in Montgomeryshire that under proper management yields may be obtained which compare quite favourably with those got in Denmark. This is an encouragement to the commercial production of seed in this country. The Aberystwyth station has now released several new strains of grasses to the seed trade, and in 1934 these strains were for the first time available to the farmer through the ordinary trade channels. The matter was taken up by the Agricultural Seed Trade Association (who also co-operated in the foundation of the Cereal Synonyms Committee), and several Seed Houses now market Aberystwyth strains of perennial ryegrass, cocksfoot, timothy, red fescue and meadow fescue.

England has now followed New Zealand's lead in starting a Certification Scheme for wild white clover. In New Zealand grasses as well as clover are certified (Ref. 10), the object being to "ensure the accurate description and wider distribution of superior strains of grasses, clovers and other farm seeds." By the co-operation of the seed merchants, who finance the growers to a large extent, seed certification in New Zealand has been a great success and the area sown with the better strains has shown a considerable increase. Many plant breeders and agriculturists look upon the certification of seed as the necessary culmination of a successful plant improvement programme, for it is certain that much of the good done by a breeding station in the production of improved strains can be nullified if there is no means for the protection and the adequate distribution of

these strains. The scheme in England and Wales has been developed by the National Farmers' Union in co-operation with the Ministry of Agriculture, and is designed to encourage and assist in the production and marketing of genuine home-produced wild-white-clover seed (Refs. 11, 12 and 22). Grade "A" certificates are issued to seed from pastures which have been down for 10 years or more, while Grade "B" certificates are reserved for seed "once grown" from genuine old pastures. In 1934 about 8,000 acres had been approved for the production of certified wild-white-clover seed, and the scheme aims at supplying all agricultural needs from certified sources.

III.—Individual Behaviour of Species and Strains.

Species and strains of herbage plants behave characteristically towards different systems of management and different conditions of soil and climate. It is a mistake to think of grassland as a homogeneous unit like a single crop variety, for due consideration must be given to the fact that no two species or strains respond in an identical manner to any of the factors which affect their value as pasture plants. Simple seeds mixtures, which shall be best suited to any given system of management or any particular set of environmental conditions, can only be compounded with a full understanding of species and strain behaviour. Conversely, grassland can be managed and utilized to the best advantage only if its botanical composition is known and understood. Some of the important characters which distinguish species and strains, and affect their agricultural application and value, may perhaps be briefly considered.

(a) *Yield.*

It is a matter of common observation that grasses do not grow at an even rate throughout the year, but have a maximum growth rate, or zenith, in May or June when the hay is taken, followed by a period of slowly waning production up till the end of October. This is followed by a rapidly waning period, which may last until the beginning of December, while the December to March period is, as a general rule, characterized by the absence of any appreciable growth. The significant consideration is that the seasonal productivity of any species or strain is determined as much by this periodicity as it is by weather conditions; hence, in order to obtain the heaviest gross yields of herbage the times of cutting must coincide with the zenith of flowering, the height of aftermath production and the end of the rapidly waning period. The first hay cut gives the heaviest yield, of course, but the aftermath varies with the species, strain and season, indigenous strains yielding a higher proportion of their total produce as aftermath than do commercial strains. Species and

strains also vary in the time of the year at which they reach the peaks of their growth, some being early while others are late. Therefore in a field of several species and strains the total yield will depend on how closely the times of cutting coincide with the maxima of these species.

Species and strains vary in the degree to which they can maintain their yield under intensive management. When grasses are constantly defoliated by repeated cutting or hard grazing their root systems and the number of their tillers are reduced. For the most part root reduction takes place to the same extent in indigenous and non-indigenous strains, but tiller production does not suffer to quite the same extent in the indigenous strains as it does in the non-indigenous. On the other hand, a species like sweet vernal grass suffers less in both of these respects than other species such as tall fescue. Reduction in either the root system or the number of tillers means that the yield suffers in the following season, so that species and strains that are least affected by heavy grazing are those which can maintain root systems and tiller numbers in spite of drastic defoliation.

There are other specific and strain characters besides gross yield which determine the amount of nutriment obtainable from an acre of grass—such, for example, as percentage of leaf, percentage of dry matter, and response to manuring. The percentage of leaf to total yield is important because the leaf is generally the most nutritious part of the plant. Indigenous strains of cocksfoot, foxtail and red fescue give the highest leaf percentages, while golden oat grass gives the lowest. Some species, like Italian ryegrass and golden oat grass, offset their low leaf production by possessing palatable stems, but this is by no means a general occurrence. It is also worth noting that species differ in their leafiness throughout the growing season. For example cocksfoot is very leafy in pasture and aftermath, while foxtail is very leafy in hay only (Ref. 13). The dry-matter percentage also varies with the stage of growth and the treatment, and is at its lowest when growth is at its zenith in May or June, or under any conditions which maintain a rapid growth-rate of young tissue. Apart from these considerations, however, the dry-matter content is definitely a specific character, and probably also varies with the strain. Timothy, crested dogstail and red fescue appear to be the grasses with the highest dry matter, while the clovers are lower than the grasses (Ref. 7).

Yield is, of course, affected by manuring, but all that can be emphasized here is that response to manuring is a strain characteristic. Thus, in the hay crop, nitrogen reduces the differences between the yields of strains because the indigenous strains are stimulated to a greater extent than the commercial

strains, so that under high-nitrogen conditions the latter do not give as high a yield, in proportion to the former, as they would normally do. The reverse takes place in the aftermath, where normally the indigenous strains out-yield the commercial strains; when nitrogen is added the commercial strains are stimulated to a greater extent than are the indigenous. But although the indigenous strains in a hay crop are stimulated by nitrogen at the expense of the commercial strains, their growth becomes stemmier and more like that of the commercial types. These examples of the effects of nitrogen all have a lessening effect on strain differences. Sometimes, however, these differences may be exaggerated, as, for example, when the total seasonal yield of high-yielding strains is very much increased in proportion to the total yield of an average-yielding strain.

(b) *Palatability.*

Palatability, as measured by the behaviour of sheep, is a characteristic of strains and species, but becomes most evident as the herbage grows older. There are also extraneous factors which affect palatability, such as position, season of the year and grazing intensity, because these factors also affect the leafiness and growth stage. In general the younger and leafier the herbage is the more palatable will it be. In the winter palatability is much reduced on account of "winter-burn." The degree to which this takes place is partly a specific character, but, for the most part, indigenous strains are less affected than commercial strains. Indigenous perennial ryegrass, crested dogstail and rough-stalked meadow grass suffer least from winter-burn, while bent and the fine-leaved fescues show the greatest damage (Ref. 7).

Timothy and Italian ryegrass are of exceptionally high palatability, while perennial ryegrass and white clover are capable of remaining palatable with increasing age to a greater degree than any other species. Other grasses of relatively high palatability, under good grazing conditions, are, in descending order of palatability, cocksfoot, crested dogstail and rough-stalked meadow grass. Cocksfoot, of course, soon becomes unpalatable when allowed to "grow away" from the stock, while crested dogstail (in common with bent, sweet vernal grass and the fine-leaved fescues) has the undesirable character of prematurely producing large numbers of unpalatable flowering heads. This not only reduces directly the value of the species, but it may also do harm indirectly to the pasture by causing whole areas to be undergrazed because of the irritation to the stock.

The less palatable species, in order of decreasing palatability, are meadow foxtail, meadow fescue, tall fescue, Yorkshire fog, bent and the red fescues. The hairiness of Yorkshire fog, like

the toothed margin of cocksfoot, is a good example of a morphological character being directly responsible for unpalatability. It is, however, dangerous to try to arrange grasses in order of palatibility or to lay down the law concerning the palatability of individual species. The observations made here are from the results of work at Aberystwyth, and although there is undoubtedly a difference in palatability between species, and probably also between strains, yet the number of external factors which affect the character are so great that any generalizations must be accepted with reserve. Inaccurate results may even be obtained from experiments designed to test palatability. Thus, although a prostrate, leafy type may be more palatable than an erect type, yet it will suffer less and be eaten in relatively less amounts merely because it *is* prostrate and more difficult to graze.

(c) *Persistency.*

By persistency is meant the ability of a species or strain to withstand invasion by unsown species and to continue to contribute to the herbage over a period of years. This character is of the utmost importance in long leys, because the more persistent species are able to prevent deterioration caused by weed invasion. It must be obvious, however, that the degree of persistency of a particular species or strain is absolutely dependent on the environmental conditions and on the system of management. Nevertheless there are certain salient points which have emerged as the result of much work on this subject.

Indigenous strains have always been found to be more persistent than commercial strains, but the degree of superiority depends on the conditions, and species vary in the range of persistency found in their various strains and nationality types (Ref. 14). Perennial ryegrass and cocksfoot show the widest range according to nationality and strain, while timothy and meadow fescue show very little variation (Ref. 15). In cocksfoot nationality appears to be particularly significant, indigenous and grazing types giving the best results from all points of view. On the other hand, indigenous strains of perennial ryegrass, when grazed intensively, persist longer and maintain their high yielding powers better than any of the other large grasses. Golden oat grass and tall oat grass cannot persist even under a light grazing treatment (Ref. 13).

Interesting observations have been made at Aberystwyth on the number of plants and tillers, per unit area, as a measure of persistency. Indigenous strains have always been found superior to commercial strains in these characters. For the most part the most densely-growing and most rapidly spreading species and strains produce the greatest numbers of tillers, while indigenous strains tiller more rapidly than commercial strains.

The most prolific tiller-producing species are perennial ryegrass, rough-stalked meadow grass and red fescue. Tiller production is, of course, important in that it not only affects the weed-combating powers of the species or strain, but it also influences the clover establishment in mixtures. Indigenous perennial ryegrass appears to be the most satisfactory grass to mix with white clover from the point of view of the clover's establishment and the prevention of weed invasion. If another good sward-forming species is added, then the most successful weed-combating mixture is obtained (Ref. 7).

In conclusion, it may once more be emphasized that specific and strain behaviour will depend on the place of origin of that species or strain, the environment under which it is being grown and its management. It may be mentioned that in New Zealand a warning has been given to growers that the best strains cannot be expected to be outstanding on poor soils, and that these must be treated well to get the best out of them (Ref. 16).

IV.—The Effect of Grazing on the Botanical Composition of the Herbage.

The system of grazing is probably the most important of all factors that affect the botanical composition of the herbage of pastures. It is no exaggeration to say that a radical change in the grazing policy of a pasture can completely change its botanical composition in the course of a few years. In parts of Australia and the United States of America large areas of natural grazing land have been laid bare by overstocking, and in some cases this has been followed by erosion of the surface soil, which has led to the permanent and total ruin of the grazing. The natural fauna may, in some cases, be responsible for the maintenance of a particular floral type in localized areas. In England it has been suggested that rabbits are the principal agents in controlling the flora of the East Anglian heaths, and while perhaps this is an exaggeration, there is little doubt that rabbits are capable of some influence.

Agriculturally, the effect of the grazing factor is very complex, because although the number and the type of stock grazed are the most important factors, the periods of grazing and the length of the rest periods are of almost equal importance. In this country overstocking generally leads to weed invasion of the pasture, while understocking allows reversion to scrub and rough grazing. It is of great importance, in considering the effects of grazing, to realize that each of the factors constituting the grazing environment will affect each species in the sward in a characteristic manner according to its persistency, power of growth and contribution to the herbage. In general it may be

said that a species or strain is successful as a grazing plant in so far as it can stand repeated defoliation with longer or shorter periods of rest, and also in so far as it is capable of rapid recovery after the defoliation (Ref. 23).

There is much evidence to suggest that many of the best permanent grazing lands of this country owe their excellence in large measure to the controlled grazing that is practised upon them. This is certainly true of the best of the midland pastures, the Romney Marsh area and the Northumberland grazing lands. In this country as a whole there is a tendency to understock in summer when the growth is greatest, instead of adopting the more desirable policy of controlled intermittent grazing throughout the year, varying its intensity according to the amount of herbage available. Such controlled grazing not only lengthens the period of maximum growth in the summer, but also ensures that the grass is kept in its most palatable and nutritious state. Above all, a system of controlled grazing can be adjusted in such a manner that the most valuable species are encouraged to contribute the bulk of the keep.

(a) *Controlled Seasonal Grazing and its Effect on Species.*

Although it is dangerous to argue from the particular to the general in discussing the effect of grazing systems on herbage species, the more extensive investigations carried out in this country are of great interest and importance because of certain guiding principles which they have in common. At Jealotts Hill the effect of four different systems of grazing on a two-year-old clover-dominant sward which had been sown to ryegrass, rough-stalked meadow grass and wild white clover showed very plainly how the clover : grass ratio is affected (Ref. 24). The best clover : grass ratio was maintained by keeping the pasturage free from stock until mid-April, and then baring down intermittently with one month's rest. Heavy grazing throughout the season, particularly in March, April and May, led in three seasons to dominance of the white clover—because of the suppression of the ryegrass by the hard spring grazing. Conversely, when the ryegrass was not grazed hard at any time, particularly in the spring, it asserted itself at the expense of the clover. But possibly the most important result was obtained when the pasture was understocked in summer and overstocked in winter, on much the same system that is common in many parts of the country. This entailed grazing only about twice the head of stock in June as in January, and the sward very soon deteriorated to bent grass and Yorkshire fog, two grasses which are found only too frequently on poor pastures throughout the country.

Investigations were also conducted on plots of permanent

pasture and showed that the method of grazing can affect its botanical composition also. From the two sets of observations it was concluded that the manuring and the mixture sown are of less importance in controlling the botanical composition than grazing. In all cases hard early-spring grazing depressed ryegrass, while hard early-spring grazing combined with summer grazing favoured wild white clover. Ryegrass flourished with late autumn and winter protection, and cocksfoot with early autumn and winter protection. In support of these results there is further evidence from some well known grazing areas. Thus, on the Romney Marsh pastures the ryegrass is suppressed and the white clover tends to become dominant by the practice of stocking ten to fourteen times as heavily at the summer peak of growth as in the winter, just as in the experiment where heavy summer and light winter grazing were combined. In the Midlands the best pastures are dominated by perennial ryegrass, rough-stalked meadow grass and bent, because of the practice of not stocking in the winter and only allowing animals to graze in the spring when there is a good growth of grass. In order to maintain a clover : grass ratio between these two extremes, controlled rotational grazing, according to the amount of growth, is necessary. Incidentally it was found that wild white clover does not feel the effects of grass competition until the end of May (Ref. 25).

Further work on these lines has shown that species may behave differently when sown alone and when sown in mixtures (Ref. 26). Rough-stalked meadow grass and crested dogstail, for example, are very much benefited by comparatively long periods of rest in the winter and spring if they are growing in pure stands. When, however, either of them is grown in a mixture with perennial ryegrass, no benefit is derived from these periods of rest because they suffer from competition with the ryegrass, which is a more vigorous grower. Wild white clover, on the other hand, appears to thrive better the less rest it receives, and its proportion in the sward was found to be almost in inverse proportion to that of ryegrass. The whole question of the suppression or encouragement of species by controlled seasonal grazing is largely a matter of competition and the time of the year at which the species reach their maximum growth rate. For example, perennial ryegrass grows most rapidly in early spring and is therefore encouraged by a rest from grazing at that time, followed by grazing when its maximum is over, and during the time when its important competitor—cocksfoot—is making its most rapid growth. Cocksfoot, on the other hand, is favoured by a reversal of this procedure, while both cocksfoot and ryegrass are encouraged by autumn resting, particularly when it is early. Perennial ryegrass, however, responds to a

later autumn rest more readily than does cocksfoot (Ref. 27).

Extensive work on the effect of grazing in several localities differing in soil and climate has confirmed much of this work just discussed. The value of this work conducted at different centres is augmented by demonstration of the fact that there was no common trend in the change of the swards under the different conditions (Ref. 29). This is only to be expected, because environmental conditions are bound to modify the effect of any treatment. With regard to the behaviour of individual species, there was agreement with the statements made above that heavy spring or autumn grazing suppresses perennial ryegrass, that hard mid-season grazing favours white clover, and that rough-stalked meadow grass suffers in competition with perennial ryegrass when the latter is rested in spring. In addition it was observed that bent grasses are encouraged by under-grazing and discouraged by hard grazing during mid-season. This is not in complete agreement with work which has been done at Aberystwyth, and this disagreement serves to emphasize the fact that although grazing factors are of vital importance in grassland management, their effects are bound to be modified by soil, climate and other environmental considerations. The results obtained at Aberystwyth showed that hard grazing with sheep once a week from early April until the end of October encouraged bent grass and clover, with one or more of the following bottom grasses—rough-stalked meadow grass, sweet vernal grass and fine-leaved fescues. This treatment also favoured annual meadow grass and small "mat" weeds. Where the plots were untouched the smaller weeds and bottom grasses were much reduced, while the coarse grasses and weeds such as cocksfoot, tall fescue, ox-eye daisy and knapweed increased considerably in amount (Ref. 5). This supports the generally accepted view that the shading effect of tall-growing species is of great importance in species competition when growth is not controlled and the plants are allowed to grow to maturity.

(b) *Effect of Periods of Rest on Tiller Production and Yield.*

Different intensities of grazing have been found to affect the density of the sward because of the direct effect of grazing on the production of tillers by the grasses (Ref. 5). Areas that were grazed most intensively produced the greatest total number of tillers, largely because of the stimulation to the bent grass, but other grasses also formed a denser mat when heavily grazed. The tiller concentration of some of the commoner grasses under three periods of rest were as follows :—

	4 Weeks.	2 Weeks.	4 Days.
Cocksfoot—indigenous	100	73	52
„ —commercial	100	4	9
Rough-stalked meadow grass	100	162	380
Crested dogstail	100	116	126
Bent	100	105	115
Yorkshire fog	100	112	114
Wild white clover	100	144	148
Miscellaneous weeds	100	122	153
Total tillers	100	105	117

It is worth noting that the various species respond individualistically to the different treatments, so that the relative proportions contributed by each species will vary with the intensity of grazing. This is merely another way of saying that the botanical composition is affected by the grazing intensity. All the constituents of the herbage, except cocksfoot, were stimulated by the shorter periods of rest. The rapid falling off in tiller production of the commercial cocksfoot in comparison with the indigenous cocksfoot is very significant in relation to the behaviour of this grass under intensive grazing. Rough-stalked meadow grass has always been regarded as the finest grass for forming a close, firm sole to a pasture under controlled grazing conditions, and its behaviour with regard to tiller production in this investigation explains its good reputation. The stimulation of white clover by intensive grazing which was referred to earlier in this discussion is also fully substantiated by these figures.

But increased tiller production does not necessarily mean an increased stock-carrying capacity nor an increased yield. Sheep grazing the pasture that was rested for four-weekly periods produced the greatest live-weight increase; those on the two-weekly rest-period pasture came next with 95 per cent.; while those on the four-day-rested pasture increased by only 85 per cent. of the amount gained by those on the four-weekly-rested plots. These figures suggest that there is an optimum intensity of grazing for all pastures and that, although intensive rotational grazing is the ideal form of management, it is not difficult to overstep the mark and indulge in a system which is not economic.

(c) *Practical Considerations.*

There are certain general guiding principles which can be deduced from this work on the behaviour of individual species. In spite of the fact that the response of species to management is very much affected by soil and climatic conditions, it is still true to say that the grazing animal is the chief agent in modifying the botanical composition of the herbage. This effect is due primarily to selective grazing by the animal, but there is also the scarcely less important effect of grazing and resting at different periods of the year, which leads to differential weakening or encouragement of species. In the early years of the life of a

pasture its botanical composition is governed by the constituents of the seeds mixture sown, but in later years the management, and in particular the scheme of grazing, assumes control. Every system of grazing awakens different competitive reactions between the species so that a readjustment of the proportions of the various species takes place. As far as the species themselves are concerned, differences in the form of growth, in palatability and in rate of growth at different times of the year all directly affect the relative proportions of these species in the sward. The relative proportions of the species, or in other words the botanical composition, is one of the chief factors determining the productivity of any grassland area, so that factors affecting it are of direct practical importance.

The main object of any grazing system is to maintain a good balance of the best pasture grasses and clovers, and to prolong the growing season as far as possible. Controlled rotational grazing with cattle and sheep is the best way to achieve this. Heavy early-spring grazing adversely affects the yield and persistency of early grasses, but it is of the utmost importance to realize that, if the plants are to be kept growing vigorously, spring and summer grazing must be hard enough to prevent rankness of growth and running to flower (Ref. 30). It is possible to take advantage of early and late grasses only if the pasture is grazed early and then rested, but when grazing is started early correspondingly long rests must be given later to compensate. All pastures require at least one good rest during the season and this rest must be followed by heavy grazing, with due consideration for the fact that the grass : clover ratio is very much dependent on the intensity and period of grazing. Hard intermittent grazing is one of the best ways of improving poor pastures because it encourages clover and improves the palatability at the expense of the productivity. It is well to remember that long-continued treatment along the same lines generally leads to some form of deterioration, only the best fields being able to preserve their excellence in the absence of occasional change (Ref. 5).

B.—WINTER-HARDINESS.

Winter-hardiness of agricultural plants is measured by their ability to withstand winter conditions without undue damage, and then to make successful growth in the spring. Crop plants and grasses vary in their winter-hardiness and are subject to varying degrees of damage on exposure to the unfavourable growing conditions of winter. Grey Winter and Black Winter oats, for example, are the only two oat varieties which can survive bad winters in this country, all other varieties showing varying degrees of winter damage. Winter-hardiness is of some

importance in grasses also, because their palatability is reduced considerably when they suffer from "winter-burn." It has already been mentioned that indigenous strains are generally less affected than non-indigenous, while some species are more winter-hardy than others. Winter-hardiness must be looked upon as being purely relative to the environment, for what is winter-hardy under one set of conditions may suffer extreme damage when grown elsewhere. Plants which are completely non-hardy are killed outright when grown in the winter, and there are varying degrees of damage to the living plant tissue in plants which show some hardiness.

The nature of winter-hardiness will depend on the kind of environmental conditions implied by "winter conditions." For the most part winter conditions involve low temperatures; drying winds; short days; cold and, perhaps, water-logged soil; or perhaps one or two of these factors may be characteristic, depending on the geographical and topographical nature of the area. But low temperatures are generally the outstanding features of winter conditions, and for the most part resistance to freezing temperatures is taken as the criterion of winter-hardiness.

Winter-killing on a large scale is not a common occurrence in this country, but autumn sown cereals are always in danger of suffering from loss of plant if a hard winter is experienced. Even in a normal winter there is often foliage damage to the young plants, caused in most cases by a combination of comparatively low temperatures, drying winds and a water-logged soil, or of any two of these factors. But although winter-killing and other forms of winter damage may be due to many causes, including the heaving of plants by alternate freezing and thawing, the first essential of a winter-hardy plant is the immunity of its living cells to freezing temperatures. Therefore it is necessary to study the behaviour of plant cells, when exposed to low temperatures, if the nature of winter-hardiness is to be understood. A great deal of work on this subject has been done in recent years.

It seems that there is no visible morphological or anatomical character which can be associated with winter-hardiness in plants; it is impossible to say from naked eye or microscopic examination what degree of hardiness is possessed by a plant. There do appear to be some characters, such as a prostrate growth habit and dark foliage, which are associated with winter-hardiness in cereals, but they are not indissolubly linked with it. If this is so, there must be some physiological difference in the functional activity of the living cells between hardy and non-hardy forms, and much research has been directed towards discovering this difference. Another problem which requires

solving is the finding of a quick, convenient and reliable means of testing winter-hardiness without the necessity of long observations through a number of winters. It is, of course, quite feasible to discover some empirical method of testing winter-hardiness without understanding the physiology, and without being able to explain the facts. In many ways it is more important for agriculture to possess a means of accurately assessing winter-hardiness than to have a scientific explanation of what constitutes winter-hardiness. Sooner or later the explanations must be found, but until they are it is the research worker's aim to use what useful knowledge he possesses. Field observations of winter-hardiness are not always reliable because environmental conditions do not repeat themselves exactly from one season to the next; but useful information can be obtained by making careful observations over a number of years, particularly if the climatic conditions are reasonably uniform from year to year. Thus in the steppe zones of Russia the cold-resistance of crops has been tested successfully by removing the snow from the plants for periods of two to three weeks at the coldest part of the year (Ref. 52). For the most part, however, it is preferable to make observations under controlled artificial conditions in order to reach a complete understanding of the question, and in order to save time, money and labour.

The response of a growing plant to changes in its environment is very complex, and any attempts to explain plant behaviour must first be concerned with a careful and critical analysis of plant relationship with the particular environmental conditions being studied. Consider, for example, the dying off of plants in the spring after a hard winter. This is generally due to the permanent injury of certain of the plant tissues during the winter or very early spring, so that there may be a distinct lag between the actual damage and its visible results (Ref. 51). It is therefore necessary to look for the injurious conditions before the actual damage is to be seen. It is possible for the plant to exhibit very obvious signs of winter damage and yet to recover completely when growth starts in the spring, but conversely, fatal damage is sometimes not obvious for some time after it has occurred. This is because different plant tissues show different degrees of susceptibility to cold, and the effect of their damage on the plant is very variable. The skin, or epidermis, is most susceptible to damage, while the young growing-points of roots, stems, and leaves, are the most resistant. Leaf tips are most often damaged by frost because they are the oldest parts, but for the most part damage of this kind does not affect plant survival. But there are certain young tissues of the stem which give rise to tillers whose damage means death for the plant. Which particular tissue is damaged is therefore of the

utmost importance for the plant's survival, and it is necessary in any study of winter-hardiness to take this into account.

I.—Methods of Testing Winter-Hardiness.

It should perhaps be emphasized that "winter" forms of cereals are not necessarily winter-hardy, neither are "spring" cereals necessarily non-hardy, the terms not being synonymous. It is of interest to note that a laboratory technique has been worked out for distinguishing between winter and spring forms of cereals (Ref 33). Apparently when wheat, barley, and oats, are germinated under constant illumination of a high intensity, the spring varieties develop quickly while the winter varieties remain dormant, and when the growing points of the seedlings are examined, differences in their size and development can be measured. In this way winter varieties of oats and barley can be distinguished from spring varieties on the seventh day after germination, while in fifteen days the bread wheats may be similarly distinguished. The investigators have also found that there is a suggestion that early and late forms can be differentiated in this manner. It will be seen that this test is based on the different reactions towards light of winter and spring forms; it is a measure of the maturation period, and as such has nothing in common with the ability to withstand winter conditions.

The most obvious, and the simplest, means of trying to measure winter-hardiness is to expose the young plants to artificially-produced low temperatures. This not only allows a study of the direct effect of low temperatures to be made, but also makes it possible to enquire into the nature of varietal resistance. Such resistance may be simply resistance to cold, as such, or else it may be bound up with the indirect effects of low temperature on the physiological processes or the cell structure of the plant. A great deal of work has been done on the exposure of plants to artificial low temperatures, and Ref. 34 gives a brief review and a full bibliography of the subject up to 1933. The crops studied include the cereals, lucerne, maize, tea and the apple tree, and most of the workers conclude that artificial refrigeration gives the most satisfactory and convenient method of assessing winter-hardiness.

Under field conditions autumn-sown cereals are "hardened off" by gradual exposure to increasingly cold conditions. Salmon found that artificial freezing of plants is a criterion of winter-hardiness in the field only if the plants have been previously hardened off. He also observed that varieties which require a long period of hardening off before exposure to freezing temperatures in the laboratory, also take some months from sowing to acquire their maximum state of winter-hardiness under field

conditions (Ref. 34). Aamodt and Platt (Ref. 35) have recently shown that winter rye and winter wheat show considerable foliage damage when frozen if they have not previously been hardened off. Spring varieties do not show this foliage damage, and these authors conclude that winter varieties require hardening off gradually before being exposed to low temperatures. This is significant because it shows that winter-hardiness can be manifested in more than one way, and even though a plant has a high survival rate it does not necessarily follow that it will not suffer any foliage damage from sudden and severe frosts. There is also a lesson to be learnt from the supposition of gradual hardening off of autumn-sown varieties in relation to sowing time and climatic conditions, because late sowing may result in premature exposure of the plants to low temperatures. Aamodt and Platt's experiments demonstrated also that the wild oat was more susceptible to direct freezing than any of the cultivated cereal varieties tested. This suggests that if this weed is stimulated or encouraged to germinate in the autumn and if the winter is sufficiently severe, a great deal of winter killing will take place.

Timopheeva, working in Russia, has obtained evidence suggesting that, after hardening had been effected, the cold-resistance of plants decreased in the course of the winter so that at the end of winter they succumbed to temperatures that would have been innocuous at the beginning (Ref. 36). Further, while winter varieties became less cold-resistant with time, non-resistant varieties became more resistant and eventually Timopheeva was able to class them as winter varieties. These results were obtained by artificial freezing and observing the percentage survival of the young plants. Timopheeva sums up his results by saying that low temperatures are "no leading factor in the process of perishing." It is a little difficult to see how he reaches this conclusion, although the behaviour of varieties varies under natural conditions in different localities and consequently winter-hardiness must also vary in its manifestation. It would probably be truer to say that low temperature, as such, is not necessarily the principal killing agency under all environmental conditions.

In addition to the direct freezing method, tests for winter-hardiness have been devised which are dependent on the physical and chemical properties of the plant cells. The amount of water left unfrozen in the cells is a guide to winter-hardiness because hardier plants are able to retain more water than non-hardy plants, and they are also capable of more rapid reabsorption of water on thawing. If a plant has been killed by exposure to low temperatures it will, of course, be quite incapable of reabsorbing water on being removed to more congenial surroundings. The

longer a plant is exposed to low temperatures in the field the less concentrated in mineral matter do its tissues become, and a general association between winter-hardiness, low salt-concentration, and high dry-matter content has been claimed by a Canadian investigator (Ref. 37). Winter-hardiness tests are now being based on these water and salt-concentration relationships of the living plant cell. The substances in solution in the sap expressed from plant tissues can be measured by electrical means and the figures obtained give a guide to winter-hardiness. This evidence can be supplemented by measuring the capacity of the tissues to hold unfrozen water (Refs. 38-42). Another line of approach is suggested by the work of a Japanese botanist who found that the hardier and later maturing varieties of rice were less resistant to the poisoning action of potassium chlorate than the non-hardy and earlier varieties (Ref. 43). A simple chemical test of this description would be of the greatest value and use if it were applicable under all conditions.

II.—Physiological Explanation of Winter-Hardiness.

For the most part the tests for winter-hardiness just described do not go far in explaining the nature of this important character. It is certain that winter-hardiness is an attribute of the living cell, and as such will probably require a complex physiological explanation which, perhaps, is of more interest to the botanical scientist than to the agriculturist. It may, however, help to complete the picture if a very brief account is given of the characteristics of winter-hardy forms so far as they are known.

The power of winter-hardy plants to retain unfrozen water in their cells, and their capacity to reabsorb water on thawing have already been mentioned. But in addition it has been shown that winter-hardy wheat varieties have a higher sugar-content than non-hardy varieties, and also that they are capable of a greater reduction in their rate of respiration (Refs. 44 and 45). This means that hardy plants are able to preserve their sugar, since respiration proceeds at its expense. This association of low respiration rate and high sugar-content with winter-hardiness appears to be a very general one. It is, however, certain that winter-hardiness is not universallyassociated with any single plant character, and may even be due to various characters in different plants. Because winter conditions vary with geographical and topographical position it is natural to suppose that the demands made on the plant to combat these conditions will also vary, so that the nature of winter-hardiness in any plant species will depend on environmental conditions. It has been shown that the winter-hardiness of certain wheat varieties in parts of Germany is due to the accumulation of sugars, together with a decreased

amount of water, in the plant tissues (Ref. 46); but this does not necessarily mean that all winter-hardy wheat varieties, under other environmental conditions, are dependent on these same characters for their winter-hardiness.

III.—The Effect of Growing Conditions on Winter-Hardiness.

Growth conditions affect winter-hardiness because it seems that all conditions which enable a plant to retain an adequate supply of organic food also enable it to remain winter-hardy. This supposition is borne out by research work which has shown that lucerne, tomatoes, cabbages and other crops retain their winter-hardiness under growing conditions which retard growth and enable the plants to store food (Refs. 48 and 49). Still further evidence along the same lines has been obtained by repeatedly defoliating winter wheat. This treatment rendered the plants less winter-hardy, presumably by stimulating growth and consequently reducing the concentration of organic food in the tissues (Ref. 47).

Attempts have recently been made to analyse the environment in order to discover the effect of various factors on the hardening and winter-hardiness of plants. The effects of temperature variation and light are of great interest, although perhaps they are obvious after what has already been said (Ref. 49). At temperatures above 0°C, hardening of the plants occurred only in the light and was due to the accumulation of organic food; while frost-resistance decreased in the darkness because the stored food was utilized by the plant. At temperatures below 0°C, hardening took place by loss of water from the plant cells, and the hardier plants contained less water, and formed less ice in their tissues, than the less hardy plants. Therefore the most suitable growing conditions for hardening plants will depend on the relationship between light and temperature. In these experiments the most unfavourable conditions were fluctuating temperatures and sunny weather during the cold season, but in sunny weather the plants hardened at a higher temperature than in dull weather because they were able to manufacture and store food. Because a covering of snow means that the plants are kept in darkness and become depleted, it may be very injurious unless it occurs at a very low temperature and when the plants are already hardened.

A great many workers have noticed that less damage is done to plants by low temperatures when they are growing on a wet soil than on a dry soil. Salmon (Ref. 34) found that there was less injury on dry soils when plants were exposed directly without previous freezing of the soil. But when the soil was frozen

before the plants were exposed there was little difference between the damage done on the wet and dry soils. It is very probable that wet soils do not become as cold as dry soils when exposed for short periods to low temperatures; they will also require a longer exposure to sink to freezing point because, for a given fall in the air temperature, a dry soil will lose more heat than a wet one. Similarly, because frost penetration is slower in wet soils, there will at least be less damage to underground parts unless there is a prolonged spell of low temperatures. It is, however, dangerous to make generalizations concerning the temperature and water relationships of the soil, and it is probably true to say that the effect of the water-content of the soil on the amount of damage by exposure to low temperatures is far from being understood.

There is a certain amount of evidence to suggest that the degree of alkalinity or acidity of the soil affects the frost susceptibility of plants (Ref. 50). Experiments were conducted on soils artificially treated with acid and alkali so that the conditions were extreme. When the plants were hardened before exposure to the low temperature the reaction of the soil had very little, if any, effect on their frost-resistance. But when the plants had not been previously hardened they were more frost-susceptible on the lime-alkalined soil than on the acid soil. This greater susceptibility was accompanied by a lower dry-matter content, a lower concentration of simple sugars and a lower water-holding capacity. The evidence available in relation to soil conditions and winter-hardiness makes it quite clear that soil type must be considered as an important factor influencing crop winter-hardiness.

Some winter varieties of cereals are characterized by rapid early-spring tillering, while growing conditions may be such as to stimulate this even when it is not characteristic of the variety. Rapid tillering means the addition of a great deal of tissue which is not hardened to low temperatures, and if cold conditions set in after the tillering has begun there may be a great deal of damage. It is not an uncommon occurrence in this country for a mild winter to be succeeded by a cold spring, with the result that well-grown winter-sown crops suffer very much from foliage damage, which in turn greatly retards growth.

The risk of winter-killing to autumn-sown crops can be considerably reduced by studying local weather conditions. By so doing the most appropriate time for sowing can be judged, with great benefit to the crops. As a general rule late sowing increases the risk of winter damage because the plants are not properly established, and have not become hardened, before wintry conditions set in. At Aberystwyth September sowings of Grey Winter oats have been found to be very much more

successful than October sowings (Ref. 73). It is assumed that this is because the better-developed root-systems of the earlier-sown plants are better able to withstand the alternate freezing and thawing that takes place during the winter.[1]

Unless conditions are exceptionally severe through the winter, spring tillering may compensate to a large extent for the loss of plant that has taken place through the winter, but a great deal will depend on whether the spring conditions are conducive to high tillering. Winter sowing, however, does not necessarily mean a higher rate of mortality than spring sowing; in fact, variety and hybrid trials at Cambridge have shown that the number of plants surviving to harvest may be greater from winter than from spring sowings (Ref. 68). The heavy loss from spring sowings is, however, due to spring droughts, and cannot be considered in this discussion, although it is a point of agricultural importance. Frost-resistance, drought-resistance, and disease-resistance, are all characters for which the plant breeder is striving, but until resistant varieties are available the agriculturist can do much to avoid damage to his crops by selecting with discrimination the times for sowing.

C.—DROUGHT RESISTANCE AND "WINDBURN."

Conditions of absolute drought are not common in this country, although there are areas where lack of moisture at certain seasons of the year has serious effects on growing crops. Also, in an uncertain climate such as is characteristic of the British Isles, periods when water is deficient for the growing of crops and grass are liable to occur at any time of the year. A shortage of water in the plant tissues may arise in various ways and is responsible for many forms of loss and damage to plants. Some forms of water-deficiency are obvious, such as wilting and windburn of the foliage of root crops and cereals, but there are also less acute effects which nevertheless have a profound influence on plant growth. For example, a comparatively slight water deficit in the plant is responsible for reducing the rate of the vital functions of the plant and consequently lowering the yield or perhaps impairing the quality of the produce. It is important for all who are engaged in growing plants to know as much as possible of the effects of climatic conditions on plant growth, and some general considerations are discussed in Reference 55.

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[1] In connection with the effect of time of sowing on winter-hardiness in wheat a Russian investigator has recently found that exposure of the germinating seeds to low temperature (Vernalization) reduces winter-hardiness. From this he argues that extra early sowings are less winter-hardy as a general rule because of the completion of the vernalization process (Ref. 75).

It is intended in this account to discuss drought-resistance and the effect of drought on plant growth.

I.—Characteristics of Drought-Resistant Crop Plants.

A shortage of water in plant tissues usually leads to the development of certain anatomical and physiological characteristics, such as the possession of smaller cells and the ability to manufacture food more rapidly (Ref. 56). This is of more than academic interest because it has been shown that drought-resistant varieties of wheat possessing small leaf-pores (or stomata) give higher yields under dry conditions than do drought-susceptible varieties with larger stomata. Conversely, under humid conditions, varieties with larger stomata give higher yields (Ref. 56). In sugar beet and maize not only do small-celled varieties give higher yields in dry years, but they also possess larger root systems. The association of large root systems with drought resistance has also been found in oats, where drought-resistant forms developed larger parts above ground as their root systems become deeper. This type of drought-resistance proved to be a heritable character, the progeny from drought-resistant parents showing increased root development in proportion to parts above ground. The worker responsible for these findings expresses the opinion that it is possible to isolate drought-resisting strains on this basis (Ref. 57).

Therefore, in contrast to frost-resistance, where there is apparently no association between any visible plant character and the degree of susceptibility or resistance, there are certain morphological and anatomical peculiarities which are associated with some forms of drought-resistance. It must not be assumed, however, that this association is always found. Unfortunately it is not, because a shortage of water in the plant tissues may be due to two forms of drought. The first—" atmospheric drought " —is associated with low humidity, which is generally caused by hot drying winds and which leads to excessive evaporation from the plant; and the loss of water cannot be made good by the root, even though there is plenty of soil moisture. This causes wilting and windburning; drought-resistant species such as millet and maize keep their stomata closed, while those that dry out, such as wheat, barley, and oats, have their stomata open. A well-developed root system and water-conducting system are also necessary to combat this form of drought. The other form of drought is " soil drought," where the soil cannot supply enough water to the plant, even though the atmosphere is relatively humid. This leads to permanent wilting of the plant, in contrast to the temporary wilting usual in atmospheric drought, and resistance is thought to be due to the power of the plant to

withstand permanent wilting without being killed. In wheat, however, some varieties can tolerate low soil moisture and others can tolerate low atmospheric moisture, while there is also varietal difference in susceptibility to early and late drought (Ref. 58). Under such complex relationships it is very difficult to make any sweeping generalization and ascribe drought-resistance in crops generally to any one particular character, although it has been suggested that drought-resistance, like frost-resistance, is largely a question of the sugar-content of the plant (Ref. 59).

II.—Effect of Droughty Conditions.

Drought-resistance is not a fixed characteristic of plants, but varies with the plant's stage of development and the conditions previous to the exposure to drought conditions (Ref. 60). The exact meaning of the term drought-resistance is the capacity of a plant to endure drought and recover readily after prolonged wilting, with the minimum of damage to the plant itself and to the yield produced. The effect of wilting at different stages of development in cereals illustrates very clearly the action of drought conditions on subsequent growth. Thus there is little effect on the later growth and yield when wilting occurs during tillering, but there is a considerable reduction in the height of the straw and the yield of the grain when the plants wilt while the culms are elongating, because more water is required at this period than at any other time in the life of the plant.

It has also been demonstrated that drying winds damage crops to varying degrees according to the plant's stage of development (Refs. 61 and 62). The most damaging time in wheat, barley, oats, beans, mustard and millet is during ear emergence and flowering. In cereals, dry winds during this period may prevent any grain being set, but as the onset of the wind becomes later, the effect becomes progressively less. Thus there may be a great reduction in the number of grains set if the wind occurs during the milk-ripe stage, while after this the grain may become shrunken in a progressively lesser degree with increased lateness of the wind. It appears, therefore, that cereals are most susceptible at earing, and become rapidly more drought-resistant after the second part of the milk-ripe stage. These experiments (Ref. 61) also showed that the growing of plants in soils deficient in water hardens them to atmospheric drought and enables them to yield more than non-hardened plants. In spite of this hardening, however, it was always found necessary to add water during flowering in order to avoid sterility of the flowers, because in all cases a deficiency of water to the plants resulted in a reduction in the number of grains set.

When there is a shortage of water, the leaves and developing

ears compete for the total amount of water absorbed by the roots. In a dry wind, and when there is abundant soil water, the leaves take all the absorbed water and the young ears dry out. When the soil water is scanty the leaves may even draw water from the developing ears, in which case they quickly become windburnt; but if the leaves are cut off the ears show no windburn at all. The relationship between the moisture-content of the soil and the extent and type of the damage done by a drying wind has been demonstrated under one set of conditions as follows. When the soil contained 20 per cent. of its total water-holding capacity, the lower leaves died from soil drought, followed quickly by the upper leaves and the ears. An increase of the moisture to 40 per cent. of the water-holding capacity led to competition between the leaves and ears, resulting in the death of the lower leaves first. Finally, when the moisture reached 60 per cent., the ears died before they did with 40 per cent. of water (Ref. 61).

It should be emphasized that a shortage of water in the leaves, which perhaps is not visible to the eye, can retard their vital processes and thereby decrease the rate of growth. A loss of approximately one-third of the normal water content of the leaf has been found to check entirely the manufacture of sugars, although the leaves looked normal, while any decrease of more than 45 per cent. of the water led to permanent injury.

Droughty conditions are also responsible for affecting the composition and quality of the grain in cereals. In wheat, for example, the ratio of protein (gluten) to starch in the grain is particularly associated with the moisture conditions from flowering until maturity, but the supply of available water before flowering is not without influence (Ref. 67). Droughty conditions reduce the rate of sugar manufacture by the leaves, and when such conditions occur after flowering the amount of starch deposited in the grain is less than if the conditions were humid. On the other hand, droughty conditions in the early stages of growth encourage the accumulation of nitrogenous matter in the plant, which is later reflected in the nitrogen-content of the grain. Speaking generally, it may be said that droughty conditions tend to produce small grain with a high gluten-content, and humid conditions are mostly associated with large starchy grain. Under hot, dry, growing conditions the yield of wheat is low, and the grain is light, shrivelled, and of a high protein-content, which is generally associated with a high water-absorbing power. This is the type of wheat usually imported into this country. Cool, humid conditions, on the other hand, ensure high yields of large, starchy, grain with a relatively high water-content, which makes it unpopular with both miller and baker. It has even bee found that wheat grown in atmospheric drought during the secon

part of the vegetative season is of superior quality when the first part of the season has also been droughty (Ref. 65). But there are so many characters involved in the term "quality" in wheat that generalizations on the effect of climate must be accepted with reservations.

The quality of malting barley is also affected by the amount of water available to the growing plant, but in contrast to quality of wheat it appears that the moisture conditions during early growth are more important than they are in the period when the plant is reaching maturity. Rainfall during April, May, and June, apparently has the greatest effect on the percentage of nitrogen in the grain, the most critical period varying with the locality and the soil conditions. Dry conditions, without approaching drought of course, are the most satisfactory for February and March, while the next three months should be amply wet. It was found at Woburn that one inch above the average rainfall in May lowered the nitrogen by ·15 per cent. on the average. Later rainfall—in July and August—is not so significant from the point of view of nitrogen percentage, but of course it is well known that it has a marked effect on the maturation, colour, size and general appearance of the grain.

III.—Breeding and Selection Problems.

The effect of drought conditions on the growing plant is more complex than the effect of low temperature; and drought-resistance resembles winter-hardiness in being a complex physiological character. There is, however, an additional complication in considering the resistance of plants to desiccating conditions because the whole life of the plant has to be studied in relation to the two forms of drought. For the most part frost-resistance is restricted to the juvenile stages of the plant, but it has been shown that drought-resistance is of great importance in cereals up to flowering. The recognition of the different forms of droughty conditions and drought damage is of great significance, and the complexity of the interrelationship between the developing plant and its water supply demands separate consideration for each set of environmental conditions, every crop and each developmental phase of the plant.

The breeding of drought resistant varieties may be approached directly by endeavouring to combine the necessary drought-resisting characters for particular environmental conditions with desirable economic characters, or else it may be approached indirectly by breeding varieties which escape the droughty periods by quickness of growth or early maturity. It is fantastic to contemplate a variety resistant to all forms of drought, but it is logical to visualize resistance to one set of droughty conditions.

Some workers consider that it is impossible to breed varieties resistant to soil drought, although they allow the probability of resistance to atmospheric drought (Ref. 65). In very dry areas, where irrigation is possible, resistance to atmospheric drought should be a definite benefit to crop yields. In this country little has been done to breed for drought-resistance, but there is a possibility that drought-resistant cereal varieties would prove useful for light soils in the eastern counties. Plant breeding, if brought to its greatest refinement, will undoubtedly have to cater for local climatic areas.[1] Recent investigations with spring wheats in Germany have demonstrated the effect of weather condition on the whole life-cycles of various varieties, and the breeding of forms adapted to the climate of localized areas is regarded as a practical proposition (Ref. 66). It seems probable that the life-cycles of varieties will have to be studied very closely in relation to breeding problems. The time of flowering and the length of the post-flowering stage up to maturity are particularly significant in connection with the selection of forms resistant to local drought conditions. A short post-flowering stage is probably associated with adaptation to dry climates and a high gluten-content in wheat (Ref. 67); while oat investigations at Aberystwyth, with varieties growing under relatively poor conditions, have revealed an association between lateness of heading, quickness of ripening, and heavy straw yield. Conditions of drought at heading were responsible for great reductions of straw yield, and differential varietal response to weather conditions indicated adaptability to definite climatic conditions (Ref. 7).

Investigations along these lines under various climatic conditions should prove of great value in helping to elucidate the problem of varietal adaptation and resistance, and thereby help in the breeding and selection of improved forms for localized conditions. Breeding for drought-resistance involves more than the study of a single unit character whose inheritance is simple and which can easily be appraised by casual observation. Like winter-hardiness it may involve obscure properties of the living organism, but its exact nature will depend on the environment and the stage of development of the plant.

D.—OAT BREEDING.

An important part of the cereal improvement work being conducted at the Plant Breeding Institute, Cambridge, is concerned with the improvement of winter oats. At present

[1] In Canada definite advances have been made in breeding for drought resistance by testing hybrid strains in a wind machine (Ref. 74).

the only winter-hardy oats are Grey Winter and Black Winter, although there are many varieties which are capable of surviving the majority of winters experienced in this country. Both the winter-hardy oats mentioned above unfortunately possess weak, fine straw, which makes them very prone to lodging, and is largely responsible for their limited growth. There is a particular demand for a good winter-hardy oat in the south-eastern districts of England where spring droughts not only reduce the yield of grain and straw of spring-sown oats, but also render them susceptible to frit-fly attack. Early sowing, of course, reduces this danger, but it is not always possible to prepare a seed-bed early enough to ensure that the crop will escape attack.

It has not as yet been possible to put on the market an improved variety with the winter-hardiness and quality of grain of Grey Winter, combined with the yielding power and standing ability of the more popular oat varieties. In the autumn of 1934, however, a new variety, Resistance, was made available to farmers and some description of its origin and characteristics is not only important in itself, but also illustrates the application of many of the principles that have been discussed in the sections on drought- and frost-resistance. A detailed account of the breeding of this new variety, and of some of the important problems in relation to the improvement of winter oats, is given in Reference 68.

Grey Winter possesses a high degree of winter-hardiness, a low husk percentage (21 per cent.), and a weak, fine straw, which makes it very liable to lodge. This variety was crossed with an Argentine oat which is not winter-hardy and has a high husk percentage (28 per cent.), but possesses an exceptionally strong straw. It was hoped that it would be possible to select, from the progeny of this cross, strains with the low husk percentage and the winter-hardiness of Grey Winter combined with the strong straw and white grain of Argentine. Low husk is undoubtedly important, because feeding experiments have shown that this character is associated with a high feeding value, but there is apparently no scientific justification for the general preference for white oats.

White-grained, strong-strawed strains were selected in the third generation, and in the following year the strains possessing a high husk percentage were discarded, together with those showing an undesirable yellowing of the leaves. The remaining families were subjected to winter-hardiness trials in this country and in Sweden. Fortunately the trials in this country included the exceptionally severe winter of 1928–29, when Grey Winter showed 86·7 per cent. plant survival while Argentine was killed out completely. None of the hybrid families had so high a plant survival as Grey Winter, there being a range of survival

rates intermediate between those of the two parents. The Swedish results, carried out at Svalöf, included freezing tests and field observations. The freezing tests agreed strongly with the 1928–29 results obtained in England, but there were many points of disagreement with the other field observations. The combined results, however, gave a very good picture of the relative winter-hardiness of the strains. It is interesting to note that the hybrid families with a prostrate or semi-prostrate habit of growth in their early stages exhibited the highest degrees of winter-hardiness and also the greatest tillering capacity. There was, however, no evidence to suggest any relationship between early growth habit and the standing capacity of the straw; nor was there any support for the view that a high husk percentage is strongly associated with an erect or semi-erect growth habit and a stiff, upstanding straw. There were a few families possessing a high degree of winter-hardiness which were also early in ripening, thus showing that it would be possible to select spring oats with winter-hardiness.

The new variety Resistance was selected from a family possessing strong, short straw; high yield; low husk percentage; and small grain. There is some prejudice against small-grained oats in some quarters, but actually there is little justification for this prejudice. "Resistance" does not possess a high degree of winter-hardiness, but it is at least as hardy as any white oat at present grown in England. It appears to be an oat suitable for rich soils, but it has not the same weed-suppressing effect as some of the long-strawed varieties (Ref. 70).

Meanwhile work is still progressing at Cambridge in the search for a superior winter-hardy variety. Several strains from the Grey Winter × Argentine cross are being studied, and the winter-hardiness tests so far undertaken suggest that it will be possible to isolate strains which are at least as winter-hardy as Grey Winter (Refs. 68, 69). There is every reason to suppose that the desirable character of winter-hardiness can be combined with strength of straw and good grain quality.

In Scotland breeding work has been directed towards the production of varieties resistant to lodging, early ripening, with high yield and good grain quality (Refs. 71, 72). The most promising strains with upstanding straw have been obtained from crosses in which the Potato oat was one of the parents, and selection for resistance to lodging has been based not only on straw length and strength, but also on the possession of a strong root system. From these Potato crosses it has been possible to select strains with shorter straw, stronger roots and earlier ripening than either parent. Early ripening has also been attempted by crossing popular varieties like Sandy and Potato with early-ripening varieties such as Sixty Day, Eighty Day,

Orion, and Black Mesdag. In Scotland grain is often lost by shedding from the panicles in oats growing in exposed situations. The variety Sandy is not subject to this grain shedding, and it has been found possible to select from crosses between Sandy with the variety Leader an improved variety called Bell, which is an early oat suitable for cultivation in late districts with poor soils. Two new varieties possessing strong straw have also been produced by the Scottish Plant Breeding Station. The first, now of some years standing, is Elder. This variety gives high yields of good-quality grain and is suitable for fertile soils and freshly ploughed grassland. The second, put on the market in 1934, is Early Miller. This was derived from a cross between the Potato oat and Record, and is an early oat suitable to general cultivation, producing straw of good feeding value and grain which promises to be very suitable for making oatmeal.

The production of improved local varieties of oats is also being pursued at Aberystwyth. Several improved pure lines, suitable for poor land at high elevations, have been selected from the old land varieties Ceirch Du Bach and Ceirch Llyd. Hybridization is, however, proving to be a more effective method of oat improvement, and it is noteworthy that crosses between different species of oats (*Avena sativa* and *Avena sterilis*) have yielded some very promising strains of high standing capacity and good grain characters (Ref. 7). In connection with the production of an improved white winter oat, trials at Aberystwyth have shown that winter oats are far superior to spring oats in yield of straw, while their grain yield is also generally higher. When a high-quality oat like Grey Winter or Black Winter is grown, even if the gross yield is not higher than that of a spring oat, its superior quality means a higher food value per acre. The weakness of straw of these two varieties is once more a bar to their general cultivation, but by crossing Grey Winter with an introduced variety called Kyko it has been possible to select two improved strains which are as winter-hardy as Black Winter. These two strains have been undergoing extensive trials in Wales, but they have not as yet become recognized varieties.

From this brief acount of recent oat-breeding work in England, Scotland and Wales, the general trend in varietal improvement may be seen. Strength of straw, and quality of grain as measured by the husk percentage, combined, of course, with good yielding powers, are the characters desired in each country. Winter-hardiness, earliness and suitability to poor conditions and high elevations are more specialized and local problems. All these desirable " economic " and " agricultural " characters are of greater or less complexity, involving problems of inheritance which by no means fit simple Mendelian hypotheses

and which demand special treatment and handling. Every cross made generally involves something new and unforeseen in the kind of progeny and the nature of the inheritance, and a keen and practised eye is required to select the desirable plants from among thousands of unwanted relations.

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DISEASES OF ANIMALS: PREVENTION AND TREATMENT.

I.—BOVINE MASTITIS.

Method of Infection and Spread of the Disease.

IN *The Farmer's Guide to Agricultural Research in* 1933 a general account was given of mastitis or inflammation of the mammary gland, leaving for future articles a more detailed discussion of different aspects of the disease. On this occasion it is proposed to refer to experiments dealing with the way in which the individual cow becomes infected and the manner in which the disease spreads through a herd. It must first be repeated that there are several forms of mastitis, each due to a different species of micro-organism, and that the most important of these is a chronic contagious form which occurs in cows in milk and which is caused by spherical micro-organisms known as streptococci. Chronic streptococcus mastitis is very widespread among dairy cows, as may be gathered from the following examples. In a report to the International Veterinary Congress of 1934, Minett (Ref. 1) stated that out of 2,530 cows belonging to 48 herds examined in England, 970 (38 per cent.) were found to be infected in at least one quarter of the udder with mastitis streptococci. The percentage in individual herds varied from 10 to 71, but no relationship could be observed between the extent of infection and the class of herd. The position on the Continent

of Europe appears to be much the same. Thus, Seelemann (Ref. 2) reported on the examination of 7,691 cows belonging to 173 herds in Germany. Of these cows, 2,539 (33 per cent.) were infected, while only 48 per cent. could be put down as certainly healthy.

The disease is one which is strictly localized in the udder and the lymphatic glands attached to it. It would, therefore, be natural to suppose that the infecting bacteria enter by way of the teat canal, but there are reasons which make it possible that this simple explanation is not the correct one. For instance, in contagious abortion of cows, the causal bacteria may be detectable only in the udder or womb, but there are good grounds for the belief that the germs of this disease commonly enter the body not by the genital passage or teat canal but by way of the mouth. Again with mastitis, the greatest difficulty has been experienced in setting up the disease by repeatedly milking cows with hands wetted with milk heavily charged with mastitis streptococci. It also remains to be explained why a cow may be infected for a long period in one or two quarters while the other quarters remain healthy.

It should be observed, however, that the difficulty of setting up the disease in the course of milking may be only apparent, because the infection habitually runs an insidious course and for a long time no symptoms may be perceptible. On the other hand, careful bacteriological examination of the milk of cows so treated has shown that it is really difficult for the streptococci to enter the mammary gland, although on other counts the evidence is strong that the teat canal is the normal channel of infection. Thus, it can readily be shown that the udder is vulnerable to infective material introduced by the teat canal, namely by infusing into the gland through a teat-syphon milk containing mastitis streptococci. The injected organisms establish themselves more easily, and set up a more vigorous mastitis, if for a few days after the operation the cow is incompletely milked or if the lining of the milk cistern is scratched. These facts are to be considered in conjunction with the inability to infect the udder by giving large quantities of contaminated milk with the food or by injecting the germs under the skin or into the veins. As to the source of the infecting streptococci, these are most probably derived from some other case of mastitis, though it has been suggested that there is a connection between mastitis and disease of the genital passages, the idea being that at parturition secretions from the passage may run down over the udder. This last point may be dismissed by stating that there is no scientific support for it, and that there is some evidence to the contrary.

Numerous attempts have been made by experimental

means to gain a clearer insight into the way in which cows become infected. Among the points investigated have been any possible difference between milking by hand and by machine, and the influence of wounds or sores on the teats.

It is not uncommonly believed that milking machines spread mastitis. This belief is apparently founded on the observation that when a milking machine is introduced into a herd where the cows have previously been hand-milked a number of cases of mastitis are liable to appear rather suddenly. It must be said at once that this does not necessarily imply that the machine is spreading mastitis. As has been mentioned before, infections of the udder which are not apparent on ordinary examination are extremely common, and the correct explanation undoubtedly is that the altered method of milking has simply had the effect of causing these hidden infections to become obvious for the time being. The observation points to the desirability of having the cows properly examined before milking machinery is put in; infected cows can then be milked by hand or at least hand-stripped after being milked by a separate machine unit. In Germany, experiments have been made to see whether machine-milking has any bad effect upon the health of the udder. The questions to which answers were desired were whether hidden or suppressed cases of the disease could be rendered active by machine-milking, whether the disease could be readily transmitted to healthy cows by the teat cups and whether improper use of the machine would injure the gland. Experiments with these objects in view have been reported by Seelemann (Ref. 3), working at the Dairy Research Institute at Kiel, and by Klimmer and Haupt (Ref. 4) at the Veterinary Hygiene Institute at Leipzig.

Klimmer and Haupt worked in a herd where 25 per cent. of the cows were infected, and the experiment was so arranged that infected and healthy cows were milked indiscriminately, machines of two different types being used. The observations were continued for about eight weeks, and weekly tests were made of the milk of each cow. During the period four fresh cases of mastitis appeared among the healthy cows, but there was no reason for believing that these had originated through the machine. In this series of tests also the machine failed to excite acute or severe changes in cows showing a chronic or mild infection.

Seelemann's experiments were carried out for a period of fourteen weeks in 1929 and for a similar period in 1930, 114 cows being used in 1929 and 100 in 1930. During the first four weeks all were hand-milked, and observations were made on the condition of the udder and on the milk yield. The animals were then divided into six groups, comparable as regards breed,

number of lactations, stage of lactation, yield and udder health. Each group contained four definitely infected animals (three of which had shown slight evidence of udder trouble during the initial hand-milking period) and twelve animals which were normal. Normal animals were milked first and affected animals last. In one group hand-milking was continued; in the other five machine-milking was substituted, machines of three different makes, but all of the intermittent vacuum type, being used. All cows were stripped by hand and tests of the milk were made every four days. There was an increased udder disturbance in several of the cows of most groups, but there was no evidence of any difference attributable to machine-milking either among the healthy cows or among those with some degree of mastitis. With regard to the improper use of machines, one point investigated was the effect of leaving the teat cups on the udder two or three times as long as was necessary for complete emptying of the gland. It could not be shown that this procedure had any adverse effect upon the health of the gland, but it would probably be unwise to accept the findings in this respect as conclusive, and there is much to be said for repeating this part of the work over a longer time and on animals of various ages. Meanwhile, so far as the health of the udder is concerned, there is no evidence to show any difference between efficient milking with a good machine and the most careful hand-milking.

For a long time the view has been commonly held that injuries to the teats predisposed the udder to enduring infection, and definite information bearing on the point has recently been provided by Bendixen (Ref. 5) in Denmark. His observations were made on a herd of 147 cows into which, for more than twenty years, no female animals had been introduced. The conditions, therefore, were ideal for obtaining a full history of the animals. The herd was free from tuberculosis but a large proportion of the animals were infected with mastitis, many of them with the kind which is not obvious. Thus 18·5 per cent. of the heifers were infected in one or more quarters, and the proportion rose with age, so that all those in the eighth or ninth lactation were infected. In the first place, the ends of the teats of all the cows were carefully examined for scars indicative of previous injury and a note was made as to the number of those which were proved by laboratory examination of the milk to be infected with mastitis. It was found that at all ages the proportion of cows showing scars near the teat orifice was considerably higher in the mastitis group than in the healthy group. For example, taking cows in the second lactation, 63 per cent. of those with mastitis infection showed scars as compared with only 9 per cent. of the healthy cows.

Subsequently, Bendixen (Ref. 6) carried out experiments which clearly showed the relationship between wounds of the teat and mastitis. For this purpose a small clean wound was made near the opening of the teat canal with an instrument, known as a teat-slitter, which is used to relieve strictures of the teat canal. Five healthy animals were used, of which three were first-calf heifers. The procedure in all cases was much the same, viz., to use the slitter on two of the four teats and then, twenty-four to ninety-six hours later, to milk the animal with hands wet with mastitis-infected milk. With the first three animals infection was produced in five out of six of the quarters of which the teats were injured, while none of the other quarters was infected. In the fourth animal one teat was incised and twenty-four hours later all four teats were moistened with a culture of the mastitis streptococcus, but without setting up infection. Eight days later a second teat was slit in the same manner and twenty-four hours later all four were milked with infected hands. The result was that infection was set up in the quarter of which the teat was last incised.

These experiments are of very great practical importance. Injuries to the teats are common, frequently arising through cows having insufficient room in the stall, so that the teats are liable to be trodden on. A most important means of prevention, therefore, is the proper construction of byres, particularly as regards the floor space allotted to each animal. The precaution should also be taken to isolate immediately cows which have received teat injuries, or have had any surgical operations on the teats, until healing is complete.

II.—Immunization of Cattle Against Tuberculosis.

Plans for dealing with tuberculosis in cattle may be divided broadly into those which depend on some process of immunization and those involving testing with tuberculin followed by segregation or elimination of reacting animals. These two plans are mutually exclusive in so far that any treatment of animals with vaccines, as prepared up to the present, is liable to make them react to tuberculin. Even so, there is no logical reason why, in badly affected herds, vaccination should not be used in the first instance with a view to reducing the proportion of infected animals before the adoption, after an interval, of what may be called the bolder policy of eradication based on tuberculin testing. In this article it is intended to deal with some of the progress which has been made in the study of methods of immunizing cattle against tuberculosis, reserving for the future an account of developments in the control by tuberculin testing. Of the vaccines which have been studied, it is necessary

now to refer to two only, and more especially to that which is known as B.C.G.

The B.C.G. Method of Immunization.

An account of this method was given in previous volumes of this publication (*vide, Agricultural Research in* 1925 *to* 1928), but as six years have elapsed since the last reference to the subject, it is necessary to recall very briefly the nature of the vaccine and the principles governing its use.

B.C.G. vaccine consists of a strain of the tubercle bacillus which has been artificially deprived of its virulence, *i.e.*, of its power to produce disease in susceptible animals. It is called "B.C.G." in short for "Bacillus Calmette Guérin." The strain was isolated in 1901 from the milk of a tuberculous cow, and was at that time a typical specimen of the tubercle bacillus which normally infects cattle. The French authors, Calmette and Guérin, in 1907, started to grow this strain on an unsuitable culture medium consisting of potato slabs soaked in ox bile and glycerine. During the following thirteen years it was subcultivated on this medium at approximately three-weekly intervals, so that in this way it was made to pass through 230 generations. It was then found that, though the bacilli had not altered in microscopical appearance, their properties had so changed that when inoculated even in comparatively large doses into calves and other animals, they no longer produced tuberculosis. When this so-called *avirulent* strain was transplanted on to more suitable culture media it retained its harmless properties, which were, therefore, considered to be fixed. It was found that calves so inoculated were resistant for several months to doses of the ordinary bovine tubercle bacillus which set up severe tuberculosis in untreated controls.

Calmette and Guérin then proceeded to field trials in self-contained tuberculous herds, the calves being vaccinated within fifteen days of birth and subsequently once a year so long as any naturally tuberculous animals were present. The idea underlying this procedure was that in such herds at the end of five years all the originally tuberculous cattle would have been eliminated through age or other causes, and the population would by that time consist of resistant individuals, which had been bred in the herd. Annual revaccinations were necessary because B.C.G. multiplies in the body to a limited extent only and is then killed off by the tissues of the body or excreted after the lapse of a year or so; also because, according to the authors' views, the animal is protected only so long as living B.C.G. are present in the body. At first the vaccine was injected into the veins, but as this sometimes produced rather disturbing reactions it was later used in a tenfold quantity subcutaneously. A

further modification found to be necessary was that calves should be vaccinated as soon as possible after birth, and in any case within fifteen days, and that they should be isolated and, above all, fed on milk free from living tubercle bacilli during the four weeks following vaccination, this time being required for the full development of the resistant state. Apart from this, no precautions were adopted and the vaccinated animals were allowed to mix freely with tuberculous members of the herd.

After these original experiments in France, B.C.G. cultures were examined and the method of immunization was tried on cattle in several countries, and the general opinion now is that the vaccine is harmless and that it does raise in a considerable degree the resistance of cattle to tuberculosis. This opinion, however, has not been universally accepted, and in *Agricultural Research in* 1928 it was pointed out that experiments carried out by the Canadian observer, Watson, appeared to show that B.C.G. might sometimes regain its power to produce tuberculosis and, further, that the resistance which it was said to produce had been exaggerated. It was pointed out that satisfactory evidence for or against the efficacy of the method would only be obtained by numerous trials in different infected herds extending over a period of years. The position then in 1928 was that the method had still to be considered as in the experimental stage, and the main purpose of this discussion is to refer to some of the experimental work which has been carried out since, and more particularly to that which has been done in this country at the Institute of Animal Pathology at Cambridge. At this Institute, work on B.C.G. has been in progress since 1926. The strain used was obtained direct from the late Professor Calmette, and preliminary experiments confirmed its harmlessness for calves when given into the veins or by the mouth. These experiments showed further that there was a considerable increase in the resistance of calves to a test dose, intravenously, of 1 milligram of normal bovine tubercle bacilli, *i.e.*, at least forty million of these organisms. The vaccine, when given by the mouth, or under the skin, or in small doses into the veins to calves a few weeks old, had no effect on health, while larger doses intravenously could be expected to produce a slight rise of temperature lasting for about a week. A second intravenous injection three or four weeks later caused more obvious symptoms, namely a rise of temperature and slight malaise for about a week, the symptoms then gradually disappearing. When such vaccinated animals were given an intravenous test dose of virulent tubercle bacilli there was a sharp and immediate reaction rather like that caused by tuberculin in tuberculous animals. In untreated animals the test dose was without apparent effect until about the end of the

first week, when the temperature rose and remained high until the animal's death.

The results of vaccination trials on calves are reported by J. B. Buxton and A. S. Griffith (Ref. 7). Fifty-one calves in good condition were vaccinated with B.C.G. by various methods —ten by feeding, four by injecting the vaccine into the windpipe, three by injection subcutaneously and thirty-four intravenously —and were tested about three months later for their resistance to tuberculosis; there were also fourteen untreated control calves of similar age, which were given an intravenous injection of virulent bovine tubercle bacilli in doses ranging from $\frac{1}{4}$ to 1 mg. All sixty-five calves used had been previously tested with tuberculin and found to be free from tuberculosis. Five of the control calves each received 1 mg. tubercle bacilli, and the average time before they died was twenty days, while one-quarter of this dose caused the death of seven control calves in an average time of twenty-four days. A dose of $\frac{1}{20}$ mg. caused the death of a control calf from general tuberculosis in sixty days. No vaccinated calf received a dose of less than $\frac{1}{4}$ mg., so that each was given not less than five to twenty times the dose necessary to produce fatal general tuberculosis in control calves.

The main interest lies in the animals which were vaccinated by the intravenous route since this, in the authors' experience, proved to be the most satisfactory method. It should be said, however, that the resistance of individual calves can be considerably increased when the vaccine is given subcutaneously, by the mouth or into the windpipe. One animal, for example, which had received six feedings with a total of 1,000 mg. B.C.G., exhibited an immunity which could be called complete. Two years after the experiment she had a calf which was reared entirely on its mother and did not react to tuberculin when one year old. Of the thirty-four intravenously vaccinated calves, all except one showed increased resistance, but there was much individual variation in its degree. Thirty-two of the thirty-four calves were vaccinated twice with an interval of twenty-one to twenty-four days, a first dose of 10 mg. being followed by one of 100 mg. in twenty cases and of 50 to 75 mg. in eleven other cases. Five of the thirty-four calves were still alive at the time of the report. Eleven of the thirty-two calves died—or were killed when apparently dying—fifty-two days, on an average, after receiving the test dose of $\frac{1}{4}$ to 1 mg. of virulent bovine tubercle bacilli, post-mortem examination revealing severe tuberculosis of the thoracic organs. Ten calves were killed in 240 days, on an average, after the test dose, because they developed symptoms of tuberculosis of the central nervous system. Post-mortem they were found to be affected with tuberculosis of the membranes covering the brain,

while the other organs of the body showed only slight tuberculous lesions. Five others were killed at times ranging from 92 to 636 days after the test inoculation and none of them showed severe tuberculosis. The actual cause of death in most of the resistant animals was tuberculosis of the central nervous system. This can be explained by the fact that the test dose contained a relatively enormous number of virulent organisms and that they were injected by way of the blood stream, whence a few bacilli would escape into the central nervous system, the resistance of which in infections is commonly low. As already stated, the degree of tuberculosis in these animals was not severe in other parts. The experiments also showed that the dosage of the vaccine is important. Thus only 50 per cent. of the calves vaccinated with 10 and 50 or 75 mg. B.C.G. showed a high resistance on test, whereas of the twenty calves vaccinated with 10 and 100 mg., 75 per cent. were highly resistant. At first sight perhaps the results are not very encouraging, but the authors point out that the test doses were exceedingly severe, and that despite this the lives of twenty-three of the fifty-one vaccinated animals were prolonged for periods ranging from eight months to three years, while, as previously stated, the controls died, on an average, in twenty to twenty-four days. The experiments thus definitely show that when B.C.G. is used in an appropriate manner a high degree of resistance to tuberculosis can be created.

In later experiments the test dose was given by the mouth, so as to imitate more closely natural infection. Griffith, Buxton and Glover (Ref. 8) reported a preliminary experiment in which six calves, which had been twice vaccinated intravenously with doses of 10 and 100 mg. B.C.G., were fed three months later, each with 5 mg. virulent tubercle bacilli. Four of the six calves were killed in 173 to 204 days after the test dose and no tuberculous lesions could be demonstrated. In two calves of similar age which had not been vaccinated, the test dose produced moderately severe local and slight generalized tuberculosis by the time the animals were killed, 172 and 194 days later.

The same authors (Ref. 9) then proceeded to determine the duration of the immunity which could be set up in calves by intravenous vaccination with B.C.G., and also the effect of revaccination upon the animal's immunity.

Before testing the duration of immunity in vaccinated calves, it was thought advisable to determine how long B.C.G. would survive in the tissues, in view of the belief of Calmette that immunity to tuberculosis is dependent upon the presence of living organisms in the body. For this purpose five calves were injected intravenously each with 100 mg. B.C.G. One

of them was killed seventy-one days later and the organisms could only be found in small numbers in one lymphatic gland; from a second, killed 120 days after injection, the B.C.G. organism could not be recovered. This indicated that four months after injection the B.C.G. organism virtually disappeared from the tissues. Nevertheless, tests on the remaining calves showed that two were completely resistant, seven to ten months later, to a dose of virulent tubercle bacilli by the mouth, and the third was definitely more resistant thirteen months later.

To test the duration of the immunity, twenty-one calves were used, of which eighteen had been vaccinated twice intravenously with doses of 10 and 100 mg. respectively and three had been similarly vaccinated once with 100 mg. These animals were tested in batches after three, six, nine and twelve months by administering virulent tubercle bacilli by the mouth, generally in a dose of 5 mg. Two unvaccinated calves were added to each batch as controls to the test feed. The results of this experiment are not quoted here in detail. It was found, however, that all controls, when killed three to six months later, showed moderately progressive tuberculosis of the intestinal lymphatic glands and that in several of them there was evidence of dissemination of the infection within the body. In the vaccinated group there was a progressive decrease as time went on in the proportion of calves which resisted, *e.g.*, in the two calves fed the test dose after three months no lesions were present, while of the seven calves fed at the twelfth month only one was free from obvious lesions, though in the others the resistance was still definitely higher than in the controls. Immunity, in fact, appeared to be almost complete up to six months after vaccination, and relatively high for much longer.

To see whether, by repeating the vaccination, a waning immunity could be restored or increased, thirteen calves, which had been doubly vaccinated intravenously with the usual doses of 10, followed by 100 mg., were divided into three groups of five, four and four calves, and the animals in each group were reinjected intravenously with 100 mg. B.C.G. at intervals of six, nine and twelve months respectively after the initial vaccination. Six months after the revaccination, the animals in each group, together with two unvaccinated controls, were given by the mouth 5 to 10 mg. virulent tubercle bacilli. Two controls were killed after 85 to 158 days and all of them showed moderate tuberculosis of the intestinal glands and in two of them there was some generalization of the disease. When the revaccinated animals were killed 84 to 166 days later, eight were free from obvious lesions, four showed lesions of slight extent and one showed moderate tuberculosis which was less

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than in the controls. It was evident, therefore, that revaccination had restored the immunity, though actually the protection was complete in fewer cases than after primary vaccination.

This article would be one-sided if no reference were made to the experiments which have been carried out by workers in other countries during the past four or five years. No more than a brief recital of the findings of the more extensive observations can, however, be made. In 1932, Rankin and his colleagues (Ref. 10) in Canada reported experiments designed to test the virulence of B.C.G. and its protective power. Sixteen calves, which had been fed with B.C.G. on three occasions shortly after birth, were allowed to run with an equal number of control calves of the same age. When slaughtered two years later all the animals were free from tuberculosis. In the protection experiments, vaccinated and control calves were fed on tuberculous milk and were also placed in contact with infected animals for about six months. On post-mortem examination after a space of two years, only six of the sixteen controls showed tuberculosis, while three of the seventeen vaccinated animals had slight lesions in some of the lymphatic glands. Actually, 80 per cent. of the vaccinated animals were free from lesions as compared with 60 per cent. of the controls.

Watson (Ref. 11), also working in Canada (and incidentally one of the foremost critics of the B.C.G. procedure), reported in 1933 experiments in which the protective power of B.C.G. given subcutaneously was tested in the face of natural infection. The duration of exposure varied from two months up to four-and-a-half years. Among forty-four vaccinated animals and twenty-eight controls, which were examined after death from two months to four-and-a-half years after exposure, nine (20 per cent.) of the vaccinated group and six (21 per cent.) of the controls were free from tuberculosis. With the remainder there was evidence that the vaccinated animals had a higher degree of resistance than the controls up to the age of two-and-a-half years, but that after this there was practically no difference in the extent of disease between the vaccinated and control groups. With regard to these experiments it may be said, however, that others have found that subcutaneous injection of B.C.G. may completely fail to immunize some animals, even when the test is made after only four to six months.

The experiments of Jundell and Magnusson (Ref. 12) in Sweden, published in 1933, show the protective effect of B.C.G. The experiments were begun in 1927 in a herd of about 200 head, half the calves born being vaccinated at birth and revaccinated annually. These young animals were kept apart from the main herd until one to two years of age, so that during this period exposure to heavy natural infection was avoided.

Post-mortem examination made in 1931 gave the following results. Of thirty-six vaccinated animals, thirty-one (86 per cent.) showed no lesions, four showed slight lesions and one was extensively affected. Of thirty-nine control animals, twenty-one (54 per cent.) were free from infection, eleven showed slight lesions and seven were extensively affected.

Observations made under ordinary field conditions have been reported since 1931 from other countries. Guérin (Ref 13), in France, has summarized the reports received from 203 veterinarians relating to 9,244 cattle. It is stated that, even when effective isolation after vaccination is not enforced, the vaccination has brought about a progressive diminution in the extent of disease in infected herds. Gerlach (Ref. 14), in Austria, among several thousand animals vaccinated, has met with no case of progressive tuberculosis due to the vaccine. In many of the herds under his observation the incidence of tuberculosis reached 50 per cent. and he reported that, while many of the unvaccinated animals died of generalized tuberculosis, the vaccinated animals remained in good health. Finally, Ascoli (Ref. 15), in Italy, reports that over 5,000 newly-born calves have been vaccinated without ill effect.

The "Diaplyte" Vaccine of Dreyer.

Reference must be made to an account which was published in 1934 by Dreyer, Vollum and Ammitzböll (Ref. 16), of a practical immunization experiment with another form of tuberculosis vaccine, viz., the so-called "diaplyte" vaccine, as prepared by the late Professor G. Dreyer, of Oxford. This vaccine, unlike B.C.G., is a dead one and it was prepared from the type of tubercle bacillus which infects man, by a process involving the use of formalin and formic acid and of acetone to remove much of the fatty material in the bodies of the organisms. The experiment was carried out in Denmark in a herd consisting, in September, 1924, of 169 animals, of which 105 were milch cows, all of which cows reacted to the tuberculin test. Most of the remaining sixty-four were young animals, and of these only seventeen failed to react to tuberculin. As only one of these seventeen was over twelve months old, it can be assumed that the chance of a calf remaining free from infection for more than a year was remote. During the experiment forty-three animals, from five to forty months of age, were purchased and many others of course left the herd through one cause or another.

The original plan of the experiment, which began in September, 1924, was to test the whole herd with tuberculin and to vaccinate half the non-reactors, leaving the remaining half as controls. Of the calves subsequently born, two-thirds were to be immunized and one-third left as controls. The tuberculin reactors in the

herd were intended to act as a natural source of infection for the experimental animals. Tuberculin tests of the vaccinated and control animals were to be made twice a year. All animals which died or were slaughtered were to be examined post-mortem. This original plan had to be modified later. It soon became apparent that the vaccinated animals were in better condition than the controls and at the owner's request all calves were eventually vaccinated. The method of vaccination practised as a routine was as follows: a dose was given as soon after birth as possible and was followed by three further doses at intervals ranging from one to four weeks; twice yearly, in spring and autumn, all the animals under experiment were tested with tuberculin by the intradermal method and then immediately injected with a dose of vaccine which was followed, two to five weeks later, by yet another dose. Most of the injections were made into the veins, gradually increasing amounts of vaccine being used; in pregnant cows the vaccine was injected into the peritoneal cavity. Animals injected intravenously sometimes showed signs of respiratory distress, but this could be easily relieved by appropriate treatment, and there were only four cases where death ensued as the result of treatment.

The experiment proceeded for nine years and during this time the original group of 142 animals, which acted as the source of infection, was gradually reduced, so that by September, 1931, only ten remained. Unfortunately, the further history of these 142 animals is scanty, but it is known that at least seven of them died from, or were slaughtered on account of, tuberculosis.

As stated, owing to a change in the original plan, very few calves were left unvaccinated. There were, however, fourteen calves which there is some justification for regarding as controls; twelve of these died or were sold at ages varying from one to 115 months, and in seven cases post-mortem examinations were made and fresh tuberculous lesions found in each case. The main interest of the experiment lies in the fate of the vaccinated group. This comprised 281 animals, of which 266 were born in the herd after the beginning of the experiment and were regularly vaccinated; the whole group was exposed to infection from feeding or contact with the naturally tuberculous animals, and no attempt was made at isolation. As previously mentioned, however, the number of naturally tuberculous animals was continually declining. The authors point out that the value of the vaccine is to be judged (1) on the results of post-mortem examinations; (2) on the results of tuberculin testing; and (3) on the clinical condition of the animals. Of the 281 animals, 107 were disposed of and post-mortem examinations were made on 55 of the 107, at ages varying from one to ninety-eight months.

No tuberculous lesions of any kind were found in forty-nine of the fifty-five, healed lesions were found in three and in the remaining three active lesions were present. These three were born at a time when 82 per cent. were definitely known to be tuberculous and the chance of infection was, therefore, much greater than at later stages of the experiment. All the vaccinated animals reacted, by the time they were three years old, to tuberculin, and theoretically this may have been due either to the vaccine treatment or to natural infection. After the age of three years the proportion reacting to tuberculin steadily decreased, and it is argued from this that the majority of the reactions among the immunized animals were due to the vaccination; if the reactions had been due to natural infection the proportion would have remained the same or would have increased. The results of such post-mortem examinations as were made also support this view. At the final test, 186 of the vaccinated animals remained in the herd and 104 of them were negative to tuberculin. With regard to the clinical condition of the vaccinated animals, only two showed any obvious symptoms of tuberculosis, whereas such cases were common in the herd prior to vaccination. In general, the vaccinated animals remained in excellent condition throughout the experiment. The outstanding result of this nine years' experiment, therefore, is that, judging from the post-mortem examination of fifty-five vaccinated animals, only 10·9 per cent. of the vaccinated group became infected, in spite of the absence of any attempt at isolation, whereas at the beginning of the experiment 90 per cent. of the herd were infected. It is considered that the procedure adopted can be applied to any herd of cattle without undue inconvenience or interference with the commercial management of the herd.

III.—The Prevalence of Tubercle Bacilli and *Br. Abortus* in Milk.

The safety and cleanliness of the milk supply is often regarded as being mainly a public-health matter, but it is also one which concerns the producer since the remedy for any defects lies primarily in his hands. Of the disease-producing organisms which may be found in milk, the bacillus of tuberculosis is the most important. The observation that tuberculous cows may excrete tubercle bacilli in their milk is an old one, and much has been written about the extent to which milk may be contaminated when it reaches the consumer. It has been shown that in this country anything from 2 to 13 per cent of the milk samples examined contain tubercle bacilli, but less is known of the extent to which milk is contaminated at the source. During the last two or three years, however, information

has been collected as to the proportion of mixed milks from individual herds and from different classes of herds which may be expected to contain tubercle bacilli, and this knowledge has been extended at the same time to *Br. abortus*, the organism which, it is now known, may cause undulant fever in particularly susceptible human individuals. Pullinger (Ref. 17), working with samples of milk delivered in London, has recently published data on this subject. He examined the following classes of milk: (*a*) certified milk; (*b*) grade A (T.T.) milk, a mixed sample representing the milk of each churn received from a single producer on a particular day; (*c*) ordinary milk, as delivered in 3,000-gallon rail tanks; (*d*) milk from non-graded herds in Cheshire and in Somerset, a mixed sample being taken as in the case of (*b*). The results are summarized in Tables I and II.

TABLE I

EXAMINATION OF MILK FROM TUBERCULIN-TESTED HERDS FOR TUBERCLE BACILLI AND *BR. ABORTUS.*

Class of Milk.	No of herds examined.			Total samples examined.	T.B.		*Br, abortus.*	
	3 Times.	Twice.	Once.		Present.	Absent.	Present.	Absent.
Certified .	11	3	5	44	0	44	28	16
Grade A (T.T.)	14	3	9	57	1	56	42	15
Total .	25	6	14	101	1	100	70	31

TABLE II

EXAMINATION OF ORDINARY MILK FOR TUBERCLE BACILLI AND *BR. ABORTUS.*

Class of milk.	Source.	Samples examined.	T B.		*Br, abortus.*	
			Present	Absent.	Present.	Absent.
Rail tank raw . .	—	63	63	0	53	10
,, ,, pasteurized .	—	63	0	63	0	63
Herd samples . .	Cheshire	105	22	83	39	66
,, ,, . .	Somerset	104	2	102	20	84

Thus it is seen that in spite of an exhaustive examination only one sample of the graded milks was found to contain tubercle bacilli, a finding which speaks well for the effect of systematic tuberculin testing. The results with the rail tank supplies show that when milk is bulked in large quantity the

whole becomes contaminated with tubercle bacilli. At first sight this is surprising when it is remembered that, on an average, not more than about one cow in 500 is affected with tuberculosis of the udder. The explanation is that the milk of cows with udder tuberculosis is usually very rich in tubercle bacilli. Thus, Pullinger found that in two out of three cases of udder tuberculosis the milk could be diluted more than one million times with normal milk without the infectivity of the mixture for guinea-pigs being lost; in the third case the milk was still infective when diluted 10,000 times. In the same connection it was noted that rail-tank milk could sometimes be diluted 100 times and still be infective for guinea-pigs. The difference between the results with the samples from Cheshire and from Somerset does not imply that in the former county the producers have any less regard for human health. The herds in Cheshire are larger than those in Somerset and the larger the herd the greater are the chances of its containing animals excreting tubercle bacilli. Also, there is evidence to show that the cattle population is denser in Cheshire, and partly in consequence of this it is possible that the prevalence of tuberculosis in any form is relatively higher in this county.

The examination for *Br. abortus* appears to show that the graded milks are more extensively contaminated than the milks of ordinary herds. This, however, is probably not the case, the difference being due simply to the greater ease with which *Br. abortus* can be detected in the cleaner milk.

These investigations emphasize the need for an extensive campaign for the eradication of tuberculosis and contagious abortion. Eradication schemes, however, must of necessity proceed slowly and, in the meantime, as has been established by the work of Pullinger and others, efficient heat treatment of milk can be relied upon to destroy disease-producing organisms in milk.

IV.—Louping-Ill and Tick-Borne Fever of Sheep.

In *Agricultural Research in* 1930 mention was made of the disease conditions of sheep which were at one time commonly included under the name "louping-ill," and an account was given of the earlier experiments designed to find the cause of that form of the disease to which the term "louping-ill" could be more properly applied. The experiments carried out for the Animal Diseases Research Association in Scotland by W. A. Pool and his colleagues (Ref. 18) pointed strongly to this form being caused by a virus of the ultramicroscopic or filterable kind, and subsequent experimentation by Russell Greig and co-workers (Ref. 19) converted this suspicion into certainty. It must be emphasized, therefore, that the term "louping-ill"

should now be applied to the disease caused by the virus in question and not to any other condition where the symptoms may be similar. In severe cases of louping-ill the virus is present in the central nervous system of the sheep, where it sets up brain symptoms and paralysis by the damage it causes to the cells of the brain and spinal cord. The disease causes considerable mortality in lambs and yearling sheep in particular localities (and often on particular pastures) in Scotland and in the border counties of England, occuring year after year in the spring and to a smaller extent in the autumn, so that sheep-rearing in these districts becomes a difficult undertaking.

Since 1930 a great deal of new knowledge has been gained by the investigators of the Animal Diseases Research Association, and the main discoveries lie in two directions. Firstly, there is the demonstration of what seems likely to prove a safe method of protecting sheep from louping-ill; secondly, another disease of sheep has been identified which is provisionally called "tick-borne fever." Both these discoveries are of great importance and it is now evident that tick-borne fever was the source of much confusion in the investigations on louping-ill before the cause of this disease was discovered.

In connection with louping-ill it has now been shown that pigs and cattle are susceptible to the virus and may suffer from the disease naturally. For experimental purposes the mouse has proved to be an extremely useful animal, since inoculation with the virus sets up a definite train of symptoms leading to death. Several human beings also have been accidentally infected with the virus and have become ill in consequence. The more recent investigations now enable a true picture to be formed of louping-ill as it affects sheep. Circumstantial evidence had for long suggested that the disease was transmitted to healthy sheep by ticks, and this has now been definitely proved as regards the species of tick which is commonly found on sheep and other animals, and which goes by the name of *Ixodes ricinus*. A few days after ticks which carry the virus have engorged themselves on a susceptible sheep, the animal's temperature rises and afterwards remains high for several days, during which time the virus can be detected in its blood, *e.g.*, by inoculation of another sheep or of a mouse. It is important to observe that not every sheep so infected shows the classical nervous symptoms of the disease; in fact, in a large proportion of sheep so infected there are either no obvious symptoms or a mild transient illness only. In such cases the virus disappears from the blood, and the animals are then immune to further infection. This accounts for the common observation that on louping-ill farms the survivors from one season afterwards remain unaffected. During the time the

virus is circulating in the blood, however, the sheep will infect any clean ticks which happen to attach themselves, and in this way the disease is maintained. It is a fortunate fact that in only a relatively small proportion of cases the virus gains access to the central nervous system of the sheep and sets up obvious disease.

Experiments by McLeod (Ref. 20), by McLeod and Gordon (Ref. 21) and by Gordon, Brownlee, Wilson and McLeod (Ref. 22) for the Scottish Association have made it clear that the tick, *Ixodes ricinus*, may transmit not only louping-ill but also "tick-borne fever." In fact, infection of ticks collected on hill pastures with the agent of tick-borne fever is very common, whereas only a small proportion of such ticks carry the more deadly virus of louping-ill. McLeod showed that if sheep are taken from an area free from louping-ill and allowed to be bitten by ticks, there may develop, three to thirteen days later, a temperature reaction which lasts for about twelve days; after this the temperature falls and the sheep are then found to be immune to a second tick infestation. They are, however, still susceptible to the virus of louping-ill when this is inoculated experimentally. It can be assumed, therefore, that the temperature reaction set up by the ticks was not due to louping-ill, since, as stated before, a temperature reaction due to the virus of louping-ill leaves the sheep immune to this disease. Further experiments proved that the temperature rise was not due to the sheep having been roughly handled or merely to a mechanical effect of the bites. The reaction, in short, was clearly due to some living infective agent which multiplied within the body of the sheep, since similar temperature reactions could be produced in a series of sheep by taking blood from them while they were feverish and inoculating the blood with a syringe. By exposing, on louping-ill pastures, sheep immune to louping-ill and others which were susceptible, Gordon and his colleagues were able to show in another way the distinction between louping-ill and tick-borne fever. Sheep which are susceptible to both diseases show two consecutive periods of fever, the first due to the virus of louping-ill and the second due to the agent of tick-borne fever. Finally, McLeod and Gordon showed that as few as two adult ticks were capable of infecting a sheep and also that the infective agent does not pass through the eggs of the tick, since larval ticks hatched from eggs laid by infected females are unable to transmit the disease. Tick-borne fever is a disease which in adults usually carries a low mortality. In lambs, however, the disease is more acute and there is reason to believe that it is responsible for much economic loss, especially in the spring months. It has been observed that in some districts sheep fail to thrive at this

season and that many deaths occur from obscure causes. Much of this mortality has been attributed by farmers to louping-ill, but probably many cases are due indirectly to tick-borne fever, which has a debilitating effect on the sheep and renders them liable to other infections. Tick-borne fever may indeed prove to be of great importance in connection with louping-ill itself and is perhaps the chief means whereby the virus is enabled to reach the nervous system. As to the nature of the infective agent of tick-borne fever, nothing is yet definitely known, nor is anything known about prevention of the disease apart from general methods of tick eradication. The only other animal so far known to be susceptible to tick-borne fever is the goat, and in contradistinction to louping-ill the mouse is insusceptible.

There is now good reason to believe that louping-ill will soon be added to the list of preventable diseases. As mentioned, sheep which have been bitten by ticks infected with the louping-ill virus frequently recover and are then immune. It has also been found that the same effect may be brought about by inoculating the virus subcutaneously. Further experience with this method has shown, however, that it is not safe to rely on the use of living virus, as the sheep sometimes develop typical louping-ill and die from it. Fortunately, virus which has been killed by means of formalin, when injected subcutaneously, appears to be just as satisfactory an immunizing agent as the living virus. Thus, Gordon (Ref. 23) has reported in 1934 the results of preliminary field trials with formalin-killed virus. In 1931, 455 sheep were vaccinated and 381 left as controls; among the former there were three cases of louping-ill and among the latter thirty cases. In 1932, 1,172 were vaccinated and 1,209 left untreated; among the latter there were eighty-eight cases of louping-ill as compared with ten among the vaccinated sheep. It is expected that the vaccine will soon be liberated for general distribution.

V.—Diseases Associated with Disturbed Mineral Metabolism.

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The word metabolism covers all the processes of building up and breaking down in the animal body, the constructive changes being referred to as anabolism and the destructive as catabolism.

At the outset two types of disease associated with mineral metabolism must be distinguished, one occurring as the result of deficiency of essential minerals in the food and the other occurring as the result of failure of the animal to keep the minerals in its blood within healthy limits. The prefix *hypo* means low and *æmia* is derived from the Greek word for blood, so that the

word *hypocalcæmia* is used to denote low blood calcium, whatever the cause may be, while the term *calcium deficiency* is best reserved for cases of insufficient calcium in the food. In the same way *hypomagnesæmia* means low magnesium in the blood and *hypophosphatæmia* means low inorganic phosphate. *Hypomineralæmia* is a general term signifying low blood minerals without specifying any particular element or suggesting any particular cause. The prefix *hyper* has the opposite meaning to *hypo*, *e.g.*, *hypermagnesæmia* or blood magnesium above normal.

Since a good deal of confusion exists in the popular mind between low mineral content of the blood and low mineral content of the food, it should be explained that although the two may be related there is no necessary connection. For example, if a maiden heifer is fed on a ration low both in phosphorus and in calcium the inorganic phosphate of the plasma, *i.e.*, the clear blood fluid in which the red corpuscles are suspended, falls quite rapidly and finally to a very low level, while the calcium tends to be arrested at a fairly definite lower physiological limit. After a year or so the plasma phosphate may have fallen from a normal of 5 mg. p.c. (milligrams per 100 cubic centimetres) even down to 1 mg. p.c., while the plasma calcium may have fallen only from 10 mg. p.c. to 8 mg. p.c.—a fall of 80 per cent. in one case and only 20 per cent. in the other. On the other hand, on a ration rich in both elements the blood calcium of a cow may drop quite unexpectedly from 10 mg. p.c. to 3 mg. p.c. within twenty-four hours of calving (milk fever) without noteworthy change in blood phosphorus.

The reason for this is that the level of blood calcium is under the influence of a rigorous physiological controlling mechanism while the level of phosphate is not—or at least not to the same extent. Hence, although hypophosphatæmia is characteristic of phosphorus deficiency in the food one cannot argue that hypocalcæmia indicates calcium deficiency.

In the case of calcium the physiological controlling mechanism is "nervous endocrine" in nature, the word "endocrine" being used to refer to certain glandular structures which secrete active principles directly into the blood stream and not through ducts. Such glands operate in association with the nervous system and co-operate with those organs of the body concerned with storage, absorption and excretion to form very complex regulatory mechanisms all of which are not yet understood. Of the glands concerned in regulating the level of blood calcium the "parathyroids," small structures in the neck in the neighbourhood of the larynx, are the most important. If these are removed experimentally the blood calcium at once falls, but this can be restored by injecting parathyroid extract. So long as they are in good working order these glands, in co-operation with the

intestines and kidneys (organs of absorption and of excretion respectively) and with the bones (organs of storage), keep the blood calcium within narrow limits (usually 8 to 11 mg. p.c.), so that even when the food contains too little the level is kept up by calling on reserves stored in the skeleton. This can go on even when the skeleton has been tapped to the point of disease.

Before discussing the commoner "hypomineralæmias" of the larger domesticated animals a few paragraphs may be devoted to the commoner skeletal disorders due to "mineral deficiency."

Skeletal Disorders.

Osteoporosis. The prefix *osteo* refers to bone, so that osteoporosis simply means a porous condition of the bones, in which the skeleton is lighter than usual. The organic matter of bone, called *ossein*, is impregnated with earthy salts which confer strength and rigidity. The chief of these is calcium phosphate, but since calcium and phosphorus are also necessary for other physiological purposes, bone is sometimes used up in times of shortage, *e.g.*, whenever these minerals are not being absorbed from the digesting food in sufficient amount. This commonly occurs in the modern high-yielding dairy cow at the height of lactation, resorbed bone being normally replaced during the dry period. The process rarely proceeds to the danger point, so that Theiler (Ref. 24) does not regard osteoporosis as a disease in itself so much as a "stage in the evolution of some disease, the last phases of which may not always be reached." In extreme cases, however, so much bone may be removed that the skeleton becomes fragile, *e.g.*, in the records of Becker, Neal and Shealy (Ref. 25) a cow averaged 6, 338 lb. of milk in eleven consecutive lactations and then broke her pelvis in three places.

Osteomalacia and Rickets. If through any cause a skeleton becomes weakened by bone resorption, it attempts to repair the damage by laying down "osteoid tissue" (bone tissue without minerals) in preparation for subsequent calcification (deposition of minerals), but if it is unable to complete the process the bone is soft and more easily bent. To this condition of excessive "uncalcified osteoid tissue" the technical name "osteomalacia" is applied. If the bone is still growing, the "epiphyses" or terminal portions of the bone are affected and the strain on these portions give rise to the well-known distortions characteristic of "rickets." But there is no fundamental difference—whether the failure to calcify osteoid tissue is manifested as rickets or as osteomalacia simply depends upon the age of the animal at the time the causal factors operate.

The causal factor may be deficiency of minerals, or of vitamin D, or of sunlight. If either calcium or phosphorus is

missing it is obvious that calcium phosphate cannot be deposited. The part played by vitamin D is not quite clear, but in some way it controls absorption of calcium from the intestine and consequent deposition in osteoid tissue. It has to be present in the food either as such or in the form of "precursors" which the body can use to manufacture *ergosterol*, a substance which can be converted into vitamin D by the action of ultra-violet rays or by the action of sunlight on the skin. Thus, the curative value of cod liver oil for rickets is due to its high content of vitamin D.

In sty-fed pigs rickets may occur as the result of bad lighting combined with the low calcium-content characteristic of cereals, and is prevented by an ordinary mineral supplement and exercise in the open. In grazing animals the commonest cause of osteomalacia and rickets is phosphorus deficiency of the pasture —very rare in Britain but common in many parts of the world (Theiler and Green; Ref. 26). The "styfsiekte" of South Africa, the "cripples" of Australia and the "knochenweiche" of Central Europe should all be called bovine osteomalacia. Aphosphorosis, *i.e.*, phosphorus deficiency disease, also occurs in sheep under various local names.

Osteofibrosis. This disease, in which the bone becomes "fibrous," is chiefly known in equines and during the years 1923–1931, before the cause was understood, was the most serious disorder of the U.S.A. military horses in the Philippines (Kintner and Holt; Ref. 27). It occurs in sporadic form in Europe as "bran disease" or "millers' disease" and in England its typical form is called "big head" because of the characteristic thickening and softening of the jaws. In less pronounced forms, however, it may pass undiagnosed and the extent to which it is a contributory cause of the common disabling disorders of horses (lameness, growths on bone, joint inflammation) deserves further investigation. The cause is an excessive proportion of phosphorus to calcium in the ration and it is likely to occur whenever the ratio of lime to phosphoric oxide (CaO to P_2O_5) is wider than one to two. It has been experimentally produced in less than a year by feeding on barley alone, which has a calcium-phosphorus ratio of one to fourteen (Niimi and Aoki; Ref. 28), and may occur when too little calcium-rich hay is fed in proportion to phosphorus-rich cereals and bran. Once the danger is recognized prevention is simple—supply mineral supplement such as ground limestone in an amount sufficient to correct the ratio.

Hypomineralæmias.

Milk Fever. As already indicated, this disease is characterized by low blood calcium but is not caused by mineral

deficiency or incorrect mineral ratio, and is far commoner amongst improved cows, bred for high milk production and fed on mineral-rich rations, than it is amongst low-yielding cows reared under ranching conditions even in areas poor in minerals (*e.g.*, parts of South Africa). The typical disease occurs just after calving, comes on suddenly and may terminate in coma (complete unconsciousness). It is therefore often termed "puerperal paralysis" and under this name has been described in animals other than the cow, *e.g.*, in the ewe, where it is also termed "lambing sickness". Examination of the blood reveals hypocalcæmia, the common fall of plasma calcium being from the normal of about 10 mg. p.c. down to half or less (range 2 mg. to 7 mg.). Associated with this, there is usually a small and variable change in blood magnesium. The amount of blood sugar also varies, usually in the downward direction, but this is secondary to the main disturbance. Any factor which temporarily raises the level of blood calcium promptly alleviates the symptoms, and the animal then usually makes an uneventful recovery. This may be accomplished by distension of the udder, as in the well-known curative treatment by inflation with air, or by injection of a soluble calcium salt into a vein or under the skin. The salt generally employed is calcium gluconate or the more soluble borogluconate (Dryerre and Greig; Ref. 29), because both these substances are less irritant than the chloride. The small amount of calcium injected disappears from the blood very rapidly (within three hours), so that it is not a question of supplying calcium needed by the body but merely of correcting for the moment the hypocalcæmia. Nature does the rest. In the case of udder inflation the older view was that damming back the milk flow stopped the drain of calcium from the blood, but the observations of Montgomerie (Ref. 30) on equine hypocalcæmia, in which symptoms were alleviated by injecting air beneath the skin, suggest that nerve stimulation plays a part.

All the evidence on causation points to a temporary disturbance of the "nervous endocrine" controlling mechanism described above, and the fact that even in normal calving of dairy cows distinct changes in blood calcium, magnesium and inorganic phosphate occur at the time of parturition (Godden and Allcroft; Refs. 31 and 32) suggests that the hypocalcæmia of puerperal paralysis is only a pathological exaggeration of normal physiological changes. Just after calving there is an enormous increase in calcium metabolism and this has to be met by increased absorption from digesting food into the blood. The increased demand is quite sudden, and to tide over the period until a new balance is struck between rate of absorption and rate of secretion the reserves of the skeleton are mobilized. When

it is considered that the blood has to carry the calcium to the udder, and that a single gallon of milk, or half a gallon of colostrum, contains more calcium than is present in the whole blood stream at any given moment, it will be obvious that lactation requires a suddenly increased effort upon the part of the physiological controlling mechanism which keeps up the calcium level of the plasma. Normally the response is immediate and, apart from a small temporary downward swing of calcium, followed by a compensatory swing in the opposite direction, the controlling mechanism performs its task. The theory is that if it lags behind in its response the blood calcium drops too far and symptoms of milk fever appear. If the hypocalcæmia is rectified by treatment, the physiological mechanism apparently gets a chance of reasserting its control. The response to a single calcium injection is often spectacular; a comatose cow may rise and behave almost normally within half an hour after artificial restoration of the balance of blood minerals by direct injection of an amount of calcium trifling in comparison with the enormous mobilizable reserves of the skeleton—which, it is assumed, could not be called up because of temporary failure of the controlling mechanism.

Lactation Tetany. This disease has come into prominence in England during the last decade, but most older veterinarians have seen it in their youth without giving it a specific name. About seven years ago mortality in Herefordshire was so pronounced that for a time the disorder went under the name "Hereford Disease," but it is now known to exist all over England. In Holland it is called "Grass Tetany", because it occurs most typically just after the cows are turned out to grass. Sjollema (Ref. 33) states that the incidence has much increased with increasing intensity of grassland management (manuring), but it seems probable that the breeding of cows for high production is the main cause of its increased incidence throughout the world, and it has been recorded in New Zealand in cows pastured all the year round. In England the incidence is also seasonal and more cases occur in April, May and June than in all the other months put together. It has, however, been occasionally reported in stalled animals in mid-winter, in almost dry cows, and at least twice in males. The onset may be sudden, the symptoms alarming, and a fatal termination rapid. In its most acute form death in convulsions may follow an hour after the first symptoms are noticed, but more usually the veterinary surgeon can reach the cow in time for successful treatment.

Hypomagnesæmia is the characteristic feature of the disease and in extreme cases the plasma magnesium vanishes almost entirely. From a normal value of about 2·3 mg. p.c. the level may drop to 0·2 mg. p.c., although a common figure is 0·7 mg. p.c.,

or about one-third normal. Blood calcium may remain normal, but usually also falls appreciably. The level of blood magnesium is related to "nervous irritability". If it falls much below normal, the response to stimuli is too active and muscular tremors, spasms and finally convulsions appear. If it is artificially raised by injection of magnesium salts, nervous irritability is reduced until finally, at the very high level of about 17 mg. p.c., complete anæsthesia (absence of response to stimuli) occurs. Treatment of lactation tetany consists in temporarily raising the level of blood magnesium by injecting magnesium salts into a vein or under the skin, so alleviating the symptoms and allowing natural recovery to take place. For this purpose magnesium sulphate (Epsom salts) is the cheapest and as good as any other form. It is non-irritant and can be injected in highly concentrated solutions—usually 50 c.c. to 100 c.c. of a 20 per cent. solution for intravenous injection or up to 300 c.c. of a 30 per cent. solution for subcutaneous injection. Absorption from a subcutaneous injection is slower but is continuous and maintains the artificially raised blood level for a much longer period of time. The Dutch veterinarians correct the hypomagnesæmia by intravenous injections of the mixed chlorides of magnesium and calcium (Sjollema; Ref. 33), using the same mixture for the hypocalcæmia of milk fever. Dryerre (Ref. 34) has recommended magnesium lactate.

In regard to the underlying cause of lactation tetany there is little precise information. Like milk fever it is almost certainly due to the temporary failure of a *nervous endocrine* regulating mechanism, but so far no particular gland has been incriminated. The hypocalcæmia which follows removal of the parathyroids is not accompanied by hypomagnesæmia (Weaver and Reid; Ref. 35), so that there is no reason to assume that they are involved. Cannavò (Ref. 36) has suggested that the anterior portion of the pituitary gland at the base of the brain controls the level of blood magnesium, but the evidence is unsatisfactory and not supported by experiments at the Ministry's Laboratory at Weybridge. The suddenness of fall of blood magnesium, the rapid response of acute cases to treatment with magnesium, and the variety of conditions under which hypomagnesæmia can occur, suggests a physiological controlling mechanism which in susceptible animals is disorganized by a variety of "precipitating causes". Thus, sudden change of environment from winter stall to pasture, a railway journey, change from hay and concentrates to rapidly growing young grass, and presumably also certain toxic factors, may all precipitate an attack. The causation of a chronic hypomagnesæmia, recorded by Blakemore and Stewart (Ref. 37), is, however, still obscure, as this condition apparently does not respond to magnesium injections.

Mixed conditions. Until recently, Milk Fever and Lactation Tetany have generally been considered independently, but Allcroft and Green (Ref. 38) have plotted charts to show that a mixed condition, in which both hypocalcæmia and hypomagnesæmia are pronounced, is nearly as common in some districts as either alone. The mixed disorder may occur either as a complication to milk fever after calving, or as a complication to lactation tetany during the season of greatest incidence of that disease, or at any other time as a typical manifestation of either disorder. In such cases many veterinary practitioners combine calcium and magnesium in treatment, or fall back on udder inflation. Fortunately, the temporary rectification of either the hypocalcæmia or the hypomagnesæmia alone is not infrequently followed by spontaneous readjustment of both calcium and magnesium—a fact which suggests that the controlling mechanisms are interrelated.

Transit Tetany. This term has been applied to a similar disease of lactating mares, though it may also occur in stallions. Hypocalcæmia was demonstrated by Montgomerie, Savage and Dodds in 1929 (Ref. 30), and further associated with hypomagnesæmia by Green, Allcroft and Montgomerie in 1934 (Ref. 39). In the equine cases the disturbance appeared in mountain ponies, which had been reared on grass, after a sixteen-hour railway journey for sale at the Menai Bridge Fair. One of the original cases of Harvey (Ref. 40) occurred after transfer from pasture to stable. The condition has also been observed in sheep, but few blood studies have been made.

Nutritional Anæmias.

The term *anæmia* simply means a reduced number of red corpuscles in the blood, or lowered *hæmoglobin*, *i.e.*, the red oxygen-carrying compound packed into the corpuscles. Anæmia may arise from various causes (*e.g.*, worm infestation), but it may also be of nutritional origin. In the case of the *bush sickness* of cattle and sheep in the Rotorua district of New Zealand, the *salt sick* of Florida, the *nakuruitis* of Kenya and the *pining* of Scotland, iron licks alone, although preferably containing a trace of copper, prevent the condition. In the case of the *Lecksucht* of cattle, sheep and goats more recently described in Eastern Holland by Sjollema (Ref. 41), an actual deficiency of copper in the vegetation seems to be the cause, and treatment with copper is more effective than with iron alone.

Since the idea that copper is an essential element in nutrition is comparatively new, the present views on its significance may be briefly explained. The red cells in the blood are formed from various parent cells in the *hæmatopoietic tissue*, *i.e.*, the "red marrow" which fills the small spaces in the bones. Iron

and not copper is a major constituent of hæmoglobin, but traces of copper are essential for the proper development of the red blood corpuscles. If an experimental animal is fed upon a diet deficient in both iron and copper, a *nutritional anæmia* results. If a purified iron salt is now added, iron is stored in the liver but very little hæmoglobin is formed in the red marrow of the bones. If copper is then substituted for iron, the liver reserves are made use of and hæmoglobin is formed. Addition of copper alone to the deficient diet causes some fresh "reticulated red cells" to be thrown into the circulation from the marrow, but the total hæmoglobin formation is small because of the insufficiency of iron. If both iron and copper are added, red cells are formed in normal abundance and the anæmia disappears.

Pig Anæmia. The case of the common anæmia of young pigs is somewhat different to the anæmias just described, since it is not the food of the adult which is at fault but the composition of the sow's milk in relation to the requirements of the litter. From time immemorial mother's milk has been regarded as the perfect food for the infants of all species, but the amount of iron it contains is low and just sufficient to carry the offspring over the suckling period. Apparently the intervention of man in selectively breeding pigs for phenomenal production has created a situation in which the demands of the fast-growing pigling for rapid hæmoglobin formation have outrun the capacity of the mother to supply sufficient iron through the milk. The fact that some piglings in a litter suffer more than others and that some litters are less susceptible to anæmia than others suggests a "genetic" or inheritance factor—perhaps operating as a capacity to make the best use of the small amount of iron available. The condition is characteristic of sty-reared piglings and rarely occurs in litters farrowed out of doors and reared on grass run, where extra iron is incidentally obtained by early rooting and swallowing of soil particles. It is easily prevented by supplying a little iron direct to the piglings—not to the mother, who already gets sufficient in her own food but is unable to increase the amount in her milk to the desired extent. Prevention can sometimes be effected by throwing freshly-cut grass sods into the sty, but is more certainly accomplished by painting the udders of the sows with a suitable iron mixture once or preferably twice a day. A suitable mixture is $3\frac{1}{4}$ oz. of iron sulphate and $\frac{3}{4}$ oz. of copper sulphate dissolved in a pint of water and then mixed with a pint of treacle or syrup to make the solution sticky and more palatable.

Pig anæmia is much commoner than many breeders suppose. For instance, Doyle, Matthews and Whiting (Ref. 42) give certain records from the United States in which 89 per cent. of

the deaths up to eight weeks after farrowing were attributed to anæmia, and Aderson (Ref. 43) discusses its importance in Northern Europe. Foot (Ref. 44) refers to the death of 10 per cent. of the pigs born at the National Institute for Research in Dairying at Reading, during the years 1931–1933, from anæmia during the first eight weeks of life, and successful subsequent prevention by iron. In general, the piglings are born with normal hæmoglobin, which ordinarily falls somewhat over the first ten days and then rises again if the iron supply is adequate but continues to fall if it is not—so leading to a *pathological anæmia* from which the young pigs may die. But when death supervenes it is not always as a simple result of the anæmia, and when recovery occurs it is not always perfect. The piglings suffer a set-back and in their weakened state are more liable to contract secondary disorders to which the healthy pigling is more resistant. Hence, whenever rearing conditions are such as to lead to suspicion of anæmia an additional supply of iron, commencing at birth and continuing until the litters are eating meal food freely, is a wise precaution.

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FARM IMPLEMENTS AND MACHINERY.

I.—Power Farming.

In recent numbers of the *Farmer's Guide* frequent mention has been made of the Survey of Mechanized Farms which is being carried out by the Institute for Research in Agricultural Engineering. What is, in effect, the first report on this survey has now been published (Ref. 1). The publication takes the form not of a connected account of the various farms concerned but of a series of notes on the technique employed on them. It is brimful of interest and information, particularly for farmers who are thinking of mechanizing their holdings. Critics of mechanization, however, are likely to find the report disappointing, for it contains very little to which even the most reactionary opponent can take exception. Stripped of its frills mechanization consists first in the replacement, partial or complete, of horses by tractors, and secondly in the use of common sense to discriminate between the essential and the unessential or, what generally amounts to the same thing, between the profitable and the unprofitable. The replacement of horses by tractors is guided by precisely the same considerations as would prompt the old-style farmer to choose a good horse rather than an indifferent one. The other new machines which the report mentions are no more revolutionary and involve no more change in the farming itself than those which were being introduced, in the face of just as much opposition, a century ago. Mechanization gives as much play as ever to those qualities which distinguish the good farmer from his neighbours. In the words of the report: "While soils differ, and the weather varies and is unpredictable, there will be room for skill and judgment in farming. There is not less room for skill or scope for judgment if one is able to get work done at ten times the pace—rather is there more demand for both."

The range of farming activities covered by the survey has increased enormously since it was started in the Autumn of 1930.

At that time mechanization was almost synonymous with specialist cereal farming—to-day, while wheat is still the most popular crop, few of the farms are confined to one or even two products. Nevertheless, as is pointed out, the purely cereal farmers were the first to demonstrate what could be done with machinery in this country: "Such farms were the first to use wide or multiple drills able to plant 50 to 100 acres per day, to harrow over 120 acres a day and over 700 acres in a week, to roll 80 acres per day, and to plough more in an hour than is usually done in a day. These and similar things are now done by many farmers whose rotations are strictly orthodox: they have become part of modern practice." With this introduction the report goes on to describe how this modern practice is carried out. It deals throughout with plain facts, and draws these, almost at random, from a wide range of examples.

The gradual extension of activities on what, two years ago, was a purely cereal farm is also discussed by Skilbeck (Ref. 2). His paper continues the account started last year by Watson (Ref. 3) of how modern methods were applied to a College farm which had to be taken in hand. Fully mechanized cereal growing proved from the start to be successful as an alternative to the losses which conventional farming had entailed, but it required only two or three men for nearly 500 acres. Now a pig unit run on Scandinavian lines has been added and provides employment for another full-time man. This unit provides an outlet for tail corn and a proportion of the straw, and the dung is being used this year for growing a trial acreage of vegetable crops. A further extension now in active progress is the adaptation of the existing farm buildings for the yard-feeding of sheep for winter mutton. If this proves successful a suitable acreage of seeds hay will take its place in the farm rotation. The farming is thus gradually becoming more "mixed" and the employment level is increasing. Each new venture, however, is virtually separate from the others and, if necessary, any one of them can be dropped or modified without prejudice to the main scheme. Although the main reason for extending the activities of the Long Wittenham farm is the desire to retain as many men as possible, a paper by Watson (Ref. 4) suggests that there is at least one other. This paper discusses farm management as applied to wheat production and points out that with ordinary methods the contribution which wheat growing on a moderate scale can make to the farmer's income is small. Three possible methods of increasing the contribution are examined: mechanization, profitable utilization of straw, and an increase in the size of the management units. Only the last of these alternatives need be considered here, for the savings which follow mechanization need no further emphasis; and there is as yet no real

prospect of being able to utilize straw in any quantity. How far then can an improvement be effected by increasing the size of the unit? In brief the answer appears to be as follows: the ruling consideration must be the organization of labour and implements at harvest time. An increase in the cereal acreage up to the limit which can be handled in a normal season by a large combine-harvester will obviously result in increased efficiency, that is, in an increased net return per acre. Beyond this, however, a greater acreage will simply mean duplication of labour and equipment without appreciable gain in efficiency. From the management point of view the gross return will be increased, but so, in proportion, will be the difficulty of supervision during the relatively short busy seasons. A better method of extending will be to add some other enterprise to the farming system, this being of such a nature and size that its busy season will coincide with a slack period on the cereal side and will just absorb whatever spare labour may be available at that time.

Among the other power farming papers that have appeared during the last year, mention may be made of a paper by Hosier (Ref. 5) describing his now familiar systems of extensive farming; and of a booklet by Dudley (Ref. 6) which gives a very complete and well illustrated account of the whole range of existing implements. Finally there may be mentioned a paper by the late G. H. Nevile (Ref. 7) whose pioneer work will long be remembered by everyone interested in the spread of mechanization. This deals in the main with the management problems that arise when modern machinery is called to the aid of an existing farm, and stresses the danger of casually adding tractors to existing horse equipment without doing all that is possible to ensure that both are being worked efficiently.

II.—Tractors.

When recently published papers on agricultural machinery are compared with similar publications of a few years ago, a striking feature is the changed attitude of those which deal with the tractor. Formerly such papers were devoted almost exclusively to pleading the case of the tractor versus the horse. They gave abstruse, and generally hypothetical calculations of relative working costs; and protested vehemently against such objections as that tractors "padded the land" or that the quality of the work depended on some mysterious property possessed only by the horse. To-day such considerations are scarcely thought of. The tractor is an accepted feature of the countryside and is in use on hundreds of farms which have no other claim to be regarded as being "mechanized" or in any way unorthodox. Present-day writers on the tractor devote their papers to questions of type and size, and the horsepower required per acre. They discuss

not whether tractors should be used, but how they can be used for everything. If they give costs at all they are real working costs based on experience and the comparison with the horse is generally left out as being beside the point. This change is very evident in the report by Newman which has already been referred to (Ref. 1). Although the farms dealt with are not all entirely horseless, he points out that on most of them the few horses that are retained are regarded only as being supplementary to the tractors. The examples which he quotes cover practically the whole range of British farming and there is abundant evidence that there is no ordinary job in which horses cannot, if necessary, be dispensed with. Actually, Newman does not press for the complete exclusion of horses, particularly where one or two can be kept at negligible expense on an odd paddock, but he does suggest that even here care should be taken to see that the amount of time spent on them is not out of proportion to their usefulness.

In regard to the number and size of tractors used for a given acreage, the practice on mechanized farms varies considerably. So much depends on the lay-out, on the capital available and on whether it is necessary to use up old equipment. It is noted that there is a general tendency to use one fairly large tractor of about 20 drawbar horsepower and one smaller one for 500 acres of arable land. Two such tractors could, if necessary, do the work of a much larger acreage, particularly on light land which can be worked under a wide range of weather conditions, but it is generally considered advisable to be over-powered rather than under-powered. Possibly on this account, night work is regarded as an expedient in late seasons rather than as a feature of regular practice.

The report gives no detailed costs of working but estimates some average figures which are interesting. The first is the overall cost of fuel and oil on fully mechanized farms, which varied from 7*s*. to 14*s*. per acre per annum according to the kind of fuel used and the acreage fallowed, and averaged 10*s*. per acre in cases in which paraffin was the main fuel. The second figure is the allowance for depreciation and repairs, which is estimated at 4*s*. per acre per annum for wheeled tractors and at about 25 per cent. more for tracklaying types. These figures are evidently based on light to medium land, for it is pointed out that the depreciation allowance may have to be increased by from 1*s*. to 2*s*. 6*d*. per acre on stiff land. In both cases the figures apply to arable land. For grassland it is suggested that a comparison can be made on the assumption that 5 acres equals one acre of arable. Detailed working costs for individual operations with tractors are given by Dudley (Ref. 8), who bases his depreciation on a 6,000 hours' life of tractor and implement with an

allowance of one-third of the first cost for repairs. This works out in practice at a standard allowance of 2*s*. per working hour —the tractors being tracklayers of about 18 drawbar horsepower. The figures for cultivations can be tabulated as follows :—

Operation.	Size of Field.	Total Time Taken.	Total Cost.		Total Cost per Acre.		Cost per Hour, including depreciation.	
	acres.	hours.	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Ploughing . .	40	42	169	0	4	3	2	0
„ . . .	6	12	46	3	7	8	1	10
Disk ploughing .	28	30	126	3	4	6	2	2
Cultivating . .	40	25	97	10	2	5	1	11
Polydisking . .	30	16	64	0	2	2	2	0
Drilling . . .	40	10	45	11	1	2	1	10

It may be useful to give some further information relating to the work covered by this table. Ploughing was generally done round-and-round, using two ploughs hitched together and making 7 furrows in all. In the smaller field a single four-furrow plough was used on account of the necessity for making frequent short turns. Disk ploughs were used mainly for throwing land up rough to lie over the winter. Dudley states that although both are included on the same basis in his example, disk ploughs are, in fact, much less costly than mould-board ploughs in repairs and replacements. Drilling was done with a battery of three 8-ft. drills, each provided with a seat on which the one man in charge could sit when necessary.

From the point of view of the tractor itself, perhaps the most interesting feature of the above table is the last column. These figures were not given in the original paper but have been calculated from the other data. The interest lies in the fact that whatever the operation, whether the field is large or small, and whether the tractor is fully loaded or not (for it is extremely unlikely that the loading was uniform over such a wide series of operations) the running costs per hour for fuel, oil, and labour are practically constant throughout. These figures provide striking support for the argument which is frequently put forward, but is all too seldom followed up in practice that, since a given tractor costs much the same to run whatever it is doing, care should be taken always to give it a full working load. This point is the main feature of a paper by the present writer (Ref. 9) which aims at clearing up some of the difficulties involved. Two of the initial difficulties are first to find out, from the information given by the tractor-maker, exactly what is the correct load ; and secondly to find out in the field whether this load, or something near it, is actually being applied. There is a

tendency for some makers to over-rate their machines but if, in addition to being told the nominal rated load, the prospective user insists on being given test figures for the maximum load, he can ensure that an adequate allowance is made for contingencies. To check the loading in the field, at all accurately, would require the use of a dynamometer but there are simple methods of estimating the speed, and if necessary the slip, which can be used to give a fairly good idea of what is happening. Another difficulty arises when in some special operation, such as combine-harvesting in a thick or laid crop, it is necessary to work at speeds appreciably lower than the lowest nominal speed of the tractor in use. In these circumstances the tractor cannot develop anything like its full power, and so must work at greatly reduced efficiency. This difficulty is serious, not because it means working uneconomically in some operations but because, to be able to do these operations at all, one may require to buy a tractor larger than is required for the other needs of the farm.

Another paper by the present writer (Ref. 10) discusses tractor design from the point of view of the engineer rather than of the farmer. On the question of working speeds it concludes that the great rolling resistance to which any vehicle is subject when operating on agricultural land will always prevent any great increase. The continued success of pneumatic tyres may modify this conclusion somewhat, but it is pointed out that these tyres have not yet had a chance of proving their all-round effectiveness in a normal season as distinct from an abnormally dry one. For the same reason it is difficult to draw any general conclusion from a paper by Smith (Ref. 11) which discusses the 686 replies received to a questionnaire on the subject of pneumatic-tyred tractors in the U.S.A. It may be said at once that the great majority of those replying were satisfied about the advantages of pneumatics. Yet, from a study of a selection of the actual replies, one cannot avoid being struck by the fact that whereas the reasons given by the minority who are dissatisfied are generally sound, the claims made in favour of pneumatics by the majority are in many cases obviously extravagant. However, pneumatic-tyred tractors have real advantages for haulage, haymaking and road use, and since the use of power is spreading to the smaller farms they are likely to become increasingly popular.

From a study of the papers so far discussed it is apparent that there is an increasing tendency to carry out tractor repairs and routine overhauls on the farm. Farm labourers are much more "mechanically minded" than is generally supposed and the younger generation, whether actually accustomed to tractors or not, generally has some sort of working knowledge of ordinary internal combustion engines. The introduction of diesel engines,

however, may cause some difficulty at first, for although superficially they are very similar to petrol or paraffin engines, there are actually considerable differences. In particular the tractor driver will find that a quite unfamiliar set of parts replaces those which, in the paraffin engine, he is most accustomed to adjust—the spark plugs, carburettor, etc. In this connection a paper by Dawson (Ref. 12) which deals with the maintenance of diesel engines, both tractor and stationary, will be of assistance. Farm mechanics are accustomed to let their tinkerings with paraffin engines stop short of the magneto : in diesel engines they must learn to treat the fuel pumps and possibly the spray-valves with similar respect. This paper explains the whole subject adequately, but makes it plain that it is, in fact, intended to serve as an introduction to the particular makers' own instruction books only.

Mechanization of the market garden depends in the main on the two-wheeled tractor which can be readily used on plots otherwise too small for anything but hand work. An account of the existing range of market garden tractors is given by Cashmore (Ref. 13) in an article which also discusses some of the practical difficulties that the user has to contend with. In general a choice has to be made between a machine of small power which is liable to be overloaded in practice and a more powerful one that in some circumstances may be difficult to control. Makers of these machines are continually developing design towards a combination of greater power and easier control and have made considerable advances in the last few years.

III.—Cultivating Implements.

The report by Newman (Ref. 1) includes some interesting particulars of the cultivation methods in use on mechanized farms. Mention has already been made of the practice of ploughing "round-and-round" and of the use of disk ploughs. Here the merits and demerits of the two are discussed. In suitable fields round-and-round ploughing saves a good deal of time and avoids much-trampled headlands. Subsequent cultivation cannot be done directly across all the furrows, but working diagonally across them appears to be quite effective. The outstanding advantage of disk ploughs is their much smaller wear and tear, particularly in stony ground. Another advantage is that, unlike mould-board ploughs, they do not tend to maintain the exact depth of previous working and so do not lead to the formation of a plough-pan. A disadvantage, perhaps not very important according to modern ideas, is that with them both the width and depth of furrow are liable to vary. A more serious one is that disk ploughs do not cover in rubbish or green crops as completely as is desirable.

A modern variant of the ordinary disk plough is the polydisk in which the disks are set on a common axle at about six inches apart. It is doubtful whether these implements can properly be classed as ploughs at all, for they are used on occasion to replace ploughs, disk harrows and cultivators. Their most successful application is in crossing ploughed-up turf. They are also used for stubble breaking when the ground is not too hard, for shallow work on fallows and for seed-bed preparation, and being made in widths up to eight feet enable work of this kind to be done very quickly indeed.

Some of the most interesting departures from normal practice are in seed-sowing. It is recognized that the ability to get a large acreage planted while conditions are favourable is one of the outstanding benefits of mechanization; and by using very wide implements and high running speeds, most power-farmers do everything to realize this advantage. In one example quoted, 917 acres were drilled in 183 working hours at an all-in cost of a little over a shilling per acre. Apart from this almost brutal speeding up of a standard operation, other methods of seed-sowing, made available by the greater working range of the tractor, are being tried. Some of them, like the American idea of broadcasting seed on the stubble and ploughing-in with a polydisk, aim simply at cheapness. Several others which aim rather at getting the seed in under better conditions are mentioned; not always as being successful. One method, which is considered worthy of a more extended trial, is to use a landpress carrying a drill box immediately behind the plough. Seed is dropped straight into the furrows made by the press wheels, and is covered in immediately by harrows attached directly behind. It is said that the seed comes up with remarkable regularity, due perhaps to its being sown on a firm, although freshly worked, bottom. The method has the advantage of being applicable over a wide range of weather conditions and, if a powerful tractor is used, of covering the ground at a very useful rate.

On the whole, power-farming has, as yet, introduced extraordinarily few changes in the traditional methods of cultivation. Almost without exception the implements used are identical in form with their earlier horse-drawn equivalents. Even the polydisk plough is new only in the sense that it has quite recently been introduced from abroad. It made its first appearance in Australia nearly thirty years ago (Ref. 14). Nor, in actual tillage operations, have speeds of working—as distinct from rates of working—materially increased. Most power-farmers prefer to use a wide implement at low speed rather than a narrow one at high speed; they get the same benefit of a faster rate of working, while the result is more like what they have been accustomed to regard as good work. There is, on the other hand, a school of

thought which sees in the use of mechanical power the possibility of altering the whole basis of soil cultivation. Its adherents argue that the traditional methods rest on no very firm foundation —that they were evolved only to suit animal power which was necessarily confined to slow speeds and which offered no alternative to drawing implements through the soil. Mechanical power on the other hand is not limited to any particular travelling speed and further can be applied directly to the soil as in the various forms of rotary cultivator.

Both possibilities are discussed by Keen (Ref. 15) in a paper which provides the agricultural background to a technical discussion of the tractor. As on former occasions, Keen is quite definitely in favour of high-speed working : " . . . there is no doubt that the farmer needs the smallest size of unit and the highest speed that can be given him," but he gives no evidence in support of his contention. Fantoni, on the other hand, claims that trials in Yugo-Slavia have shown that faster ploughing results in a substantially increased yield (Ref. 16). In these trials adjacent plots were ploughed at 1·3 and 4·7 miles per hour respectively and were afterwards harrowed and drilled with wheat. On what is described as poor land the yield on the plots ploughed at 4·7 miles per hour was nearly 14 per cent. greater than on the others, although on better land the corresponding increase was only about 1 per cent. Other experiments, in which beet and maize were grown, also showed substantially increased yields. The higher yield was attributed to the fact that whereas after the slow ploughing the furrow slices remained practically solid, at higher ploughing speeds they were disintegrated and strewn throughout the whole working depth. These experiments appear to have been conducted efficiently and to have been repeated often enough to ensure that the result was not a chance effect due to some special circumstance. They would therefore appear, at first sight, to lend considerable support to the idea that increased working speeds are in themselves advantageous. But is this, in fact, a fair conclusion to draw? In the first place all that the experiments really prove is that on the particular soils used the furrow slice needed to be thoroughly disintegrated *at some time previous to sowing*. It can be argued, for example, that the same degree of disintegration could probably have been obtained at a lower speed by using a more convex plough-breast ; or it can be argued that the subsequent harrowing was inadequate in the case of the slower ploughing. Even if it be granted that faster ploughing produced in one operation a result which with slower ploughing would have needed several operations, the general case for fast ploughing is not made out. Indeed this is precisely the claim made for rotary tillage which, in spite of years of experiment, can hardly be said to be an established success.

In the paper already quoted Keen discusses rotary tillage at some length. The common type of rotary tiller is that in which the tines are attached to a horizontal shaft which revolves at high speed, and it is with this type of machine that most experiments on the subject have been carried out. Experiments in which seed beds prepared with such machines are compared with those prepared by orthodox methods nearly always give the same result. The rotary tiller produces a fine deep tilth on which germination and early growth are especially good. In the later stages, however, the rotary-tilled plots fall behind, due partly to the greater weed growth on them, and partly to their tendency to settle and "cap" after rain. Keen maintains that these effects are not due to the "fineness" of the tilth, and quotes sieving experiments which show that the proportion of small-sized particles produced by rotary tillage is not excessive as compared with the proportion resulting from ordinary methods. He ascribes the weed difficulty to the fact that the rotary implement mixes all the soil and so distributes weed seeds to the full depth of the tine entry; and the settling and capping difficulty to the fact that the tilth is loose so that, for example, a four-inch depth of untilled land produces a six-inch depth of tilth. Keen goes on to describe the gyrotiller in which the tines are attached to nearly vertical shafts so that each part of them moves horizontally through the soil, and suggests that this design may overcome the defects mentioned above. In this connection reference may be made to a paper which describes the working of the gyrotiller in Scotland (Ref. 17). This paper gives general particulars of the machine and of its mode of operation, but its most interesting feature is a section devoted to the comments of the farmers on whose land it worked. Some farmers were emphatically of the opinion that gyrotillage resulted in increased yields of wheat and roots and, with the latter crop, in a noticeable improvement in quality. They also recognized the beneficial effect of deep cultivation on drainage. There were, on the other hand, a number of adverse comments: in some cases subsoil was brought to the surface; in others the land was left in a ridged formation which could be levelled only with difficulty. When old lea on clay was cultivated, large clods of turf were left and were afterwards expensive to break or remove. In some cases the fine tilth made subsequent horse cultivations difficult, while in one case this tilth ran together into a crust and had to be broken down again.

Perhaps neither the advantages nor the disadvantages are as significant as they may appear. Deep cultivation, particularly in a horse-farming district, is almost certain to be beneficial the first time it is done. Whether repeated deep cultivations will be worth their extra cost is another matter; and whereas deep cultivation can be done reasonably well with a tractor, it can

hardly be economical to use a gyrotiller for shallow work. On the other hand, it is probable that the dangers of bringing subsoil to the surface are in many cases exaggerated—on at least one well known farm it is done deliberately because it is regarded as beneficial (Ref. 25). Again it should be possible with more experience to work the gyrotiller in such a way as to avoid the occasional ridging effect which some farmers complained of. Perhaps the most serious objection lies behind the criticism that the fine deep tilth made subsequent operations difficult and in one case resulted in "capping." It is an objection that may apply to any method of cultivation which aims at producing a deep tilth in one operation, whether it is gyrotillage, rotary tillage or high-speed ploughing. None of these methods can allow anything like the margin of error which the traditional step-by-step methods do. With the older methods, not only can advantage be taken of natural processes in producing a tilth, but each operation in turn can be judged and varied in the light of the weather conditions which have followed the preceding one. Traditional methods, in fact, play for safety at each stage and the man who applies them with discretion can generally be assured that the final result is as near perfection as the weather has allowed. The user of a one-operation method, on the other hand, has to take a chance. If the weather is kind, all is well, but if it is not he is quite likely to find himself in difficulties.

Further light on the connection between deep tillage and drainage is provided by Nicholson (Ref. 18) in a paper on the mode of operation of mole drains. Reference has already been made in the *Farmer's Guide* to the drainage study of heavy Gault clay which is proceeding at Cambridge, and much of the material contained in the paper has already been discussed. In this case, however, further consideration is given to the permeability of the upper soil: that is, to the manner in which water gets from the surface into the neighbourhood of the drain channel which is intended to carry it away. Experiments of various kinds showed that at depths beyond the normal depth of cultivation in the case of arable land, or below the depth of root penetration on grassland, this heavy soil was practically impermeable to water in winter. A head of water established within retaining walls on the surface did not drain away for many hours unless it happened to be placed right over the slit of a mole channel. Mole channels, therefore, were apparently useless as a general drainage system on heavy clay where only shallow cultivations were practised. Permeability was also studied in another way, *viz.*, by removing blocks of soil without disturbance and impregnating them with a molten wax-naphthalene mixture. This mixture penetrated and filled up all the

natural interstices in the soil and their nature and distribution could then be studied by cutting the blocks into sections. This method confirmed the conclusions reached above, for on shallow-worked land the frequency of the interstices decreased with depth so that they rapidly became negligible as a factor in drainage. A similar study of gyro-tilled plots showed a very definite fissuring of the soil even after fifteen months of ordinary cultivation. The larger fissures apparently corresponded with the divisions between the clods in which the gyrotiller had left the land, while a network of smaller channels, resulting from weathering, was apparent within the clods themselves. This experiment offered definite support to the idea frequently stressed by early writers that deep cultivation or subsoiling is a necessary adjunct to the efficient mole drainage of clay. In the words of the paper: "All the evidence points to run-off through the surface tilth to the mole slits. It would follow that the deeper the tilth the more the nature of the flow should approach that of the light-land drain." One comment may perhaps be made on this question of deeper tilth. On this heavy land the gyrotiller left the land in a cloddy state and subsequent improvement in drainage was mainly due to fissures left between the clods. On rather lighter, but still heavyish land, or even on the same land if tilled when in a different condition, the stirring action of the gyrotiller might well tend to fill up the interstices between the clods with finer particles. In these circumstances straightforward subsoiling—fissuring the subsoil without producing any finer particles—would probably produce a more efficient drainage action.

Nicholson also gives some interesting information about the way soil dries out in summer from the surface downwards and is re-wetted in the same way in the winter. The drains did not run until the soil had been charged up to its normal winter moisture-profile, that is, until the descending water front had reached the level of the drains. Similar conclusions were reached in an American study of tile drains: heavy outflow did not necessarily follow closely on heavy rainfall, but was dependent on the texture of the soil and subsoil and on the moisture content of the soil preceding the rainfall (Ref. 19).

IV.—Harvesting Machinery.

Developments in harvest machinery during the past year include several variations of the Combine harvester which are either new in themselves or new to this country, and the first trial of a promising alternative system. At the same time the ever wider application and continued success of "combining" with ordinary types of machine entitles it now to be regarded as a standard British method. From this point of view a paper

read by the late G. H. Nevile at the Harper Adams Power Farming Conference is of considerable interest (Ref. 20). This paper is, in effect, a condensed treatise on Combine Harvesting based on four years' working experience with three machines. The capacity of a 10-foot Combine in a normal season is estimated at 400 acres. The ability to cut such a large acreage, however, depends on the cropping being planned so as to spread the harvest over as long a period as possible : with winter wheat alone, for example, the working acreage for a single machine would generally need to be reduced. It also depends on not overloading the machine by trying to get a perfectly dressed sample of grain. A second dressing is, in any case, generally necessary before marketing, and it is best therefore to leave the bulk of the cleaning to be done in the barn. Possibly, because harvest seasons have been favourable rather than the reverse, little has been heard recently about the practice of "windrowing." This paper describes how windrowing was used successfully to harvest peas and badly laid barley, but does not recommend its use in the ordinary way. It also gives a great deal of useful information about grain drying. In the 1933 harvest drying was generally unnecessary, but in each of the three preceding years some rain fell on about forty days during harvest and "combining" without a dryer would have been impossible. However, if a few simple rules are observed, drying presents no difficulties and does not in any way impair the quality of the grain. The most important points are to make sure that the grain is dry enough, but at the same time to avoid using too high a temperature. The particulars of working costs given by Nevile agree fairly closely with other estimates that have appeared from time to time. As compared with costs by ordinary methods they show an advantage in favour of combine harvesting of about £1 per acre. Against this must be set the value of the straw for, although the greater part of it can, if necessary, be collected in reasonably good condition, the cost of so doing has not been included. Generally speaking combine users have so far regarded straw as being barely worth the expense of collection and, with a view to making matters easier for the machine, have often left a rather long stubble. The extreme limit to which one can go in this direction, without actually threshing the ears as they stand, is represented by the Auto-header, an Australian machine recently tried in this country (Ref. 21). As its name implies, this machine in theory cuts no straw at all, and in practice only just as much as is necessary to avoid missing "necked" ears. It differs from other machines also in that it is self-propelling and has a front cutter bar covering the full width of the machine. It can thus be driven straight into any field without the need for opening up by other means. Mainly because of the reduced bulk passing

through the threshing and cleaning mechanism, the rate of working of this machine was appreciably faster than that of an ordinary Combine, and, for the same reason, a cleaner sample was delivered. The stubble in this case consists of course of practically all the straw, much trampled by the passage of the machine. It is doubtful whether it can be ploughed in, unless very deep ploughs can be used, and it will generally need to be burnt—as was done this year. It remains to be seen whether burning can be done successfully over a range of normal seasons.

While combining has undoubted advantages quite apart from reductions of cost, the fact remains that the man to whom straw is worth more than £1 per acre cannot afford to adopt it, at any rate in its present form. This fact is recognized in the design of a new German harvester thresher (Ref. 22 and 23). This machine is arranged so as to be pushed and driven by a standard tractor and it can enter a field without opening-up, in the same way as the Australian machine just described. Its most attractive feature, however, is the way in which the crop is handled after cutting. In the normal type of combine the crop as cut is bundled, end on, into the threshing drum, so that not only is the straw unnecessarily broken, but the threshed grain and broken straw are so mixed together that fairly elaborate equipment is required to separate them. Further, because in a machine which has to travel around fields only a limited space can be allowed for this equipment, there is a limit to the bulk that can be passed through, and so Combines in general cannot handle full-length straw in an English crop. In the new German machine the crop is carried from the cutter-bar platform by an ingenious band conveyor which grips the butts and allows the ears to hang downwards. In this position it is delivered to a vertical drum from which practically all the grain falls without ever getting into the straw. For this reason elaborate separating equipment is unnecessary and it is claimed that long straw can be handled without fear of choking and without being badly broken up. At the time of writing one of these machines is undergoing its first trial in England and the result is being awaited with considerable interest.

Another new machine, about which only the most meagre particulars are available, is being tried in France (Ref. 24). This machine is known as the Harvester-Thresher-Binder and, if its working has been correctly understood, it manages to convey the cut crop so that only the ears are threshed while the straw passes on to a binder deck where it is bound into sheaves and ejected in the ordinary way.

In the last number of the *Farmer's Guide* a new method of harvesting lucerne for artificial drying was described. This device, which consists essentially of a binder in which an elevator

takes the place of the binding deck, has now been tried in grain harvesting (Ref. 25). The cut material is delivered loose into a trailer haûled alongside and is taken direct to a self-feeding threshing machine. It is claimed that this method achieves the main object of combine harvesting by eliminating the labour required for handling and stacking sheaves while, since it allows an ordinary threshing machine to be used, it produces a clean sample of grain and saves all the straw. The number of men required is necessarily greater than in combining, but the cost, excluding depreciation, is stated to be no more than 9*s*. per acre. This cost includes that of artificially drying the grain, which is an essential feature of the method.

A general review of harvesting problems, dealing briefly with most of the developments outlined above, has been given by Denham (Ref. 26) in an article which closes with an appeal for co-operative organizations for cleaning, grading and storing grain. In another article (Ref. 27), the same writer suggests that mechanized farmers might find that extra expenditure on up-to-date grain-cleaning machinery was justified by the extra price that they would get for a properly cleaned sample. He points out that with modern methods impurities and poor grains do not get a chance of becoming shrivelled in the stack, so that cleaning is necessarily more difficult. The paper goes on to outline the working principle of various forms of grain-cleaning appliances in a way that will be helpful to farmers who may wish to modify their own machines.

V.—Electricity.

To judge by the comprehensive electrical exhibits that are a feature of present-day agricultural shows, very rapid progress is being made in the application of electricity to agriculture. It is difficult to think of a farming operation requiring power, heat or light for which an electrically operated device cannot be supplied. A recent review (Ref. 28) describes many possible applications and it would not be difficult to think of almost as many more. How widely these devices are actually being used in everyday farming and, more important, how widely they are likely to be used in the future, are matters more difficult to discuss.

In the first place no electrical "gadget," however attractive, can be used until a supply of electricity is available, and the cost of connecting this—necessarily but conveniently omitted when relative working costs of electrical and other equipment are discussed— is (in the words of the review mentioned) "still the rock on which most schemes for farm electrification are wrecked." Again, even when a supply is available, it is often difficult for a prospective user to find out in advance what the

actual cost of electricity will be. It is easy enough, for example, to show that, if electricity can be bought for a penny a unit, an electric motor will in the long run be an economical alternative to a stationary engine for driving barnyard machinery. It is not nearly so easy to demonstrate in any given case that a penny per unit is about what the electricity will cost, for this may depend on all sorts of factors from the number of rooms in the farmhouse to the total number of units used per annum. This is well illustrated in a recent paper (Ref. 29), which discusses farm tariffs in general and also their application to a particular instance. The case chosen was that of a forty- to fifty-cow dairy farm, actually situated near Oxford, but assumed for the purpose of the enquiry to be situated in a number of different supply areas. All necessary particulars about the farm and its equipment were known and for each supply area the average cost per unit of the electricity actually consumed in 1934 was worked out according to the particular tariff applying in each area. The results show a very wide variation : from a little under a penny per unit in one or two exceptionally favourable districts to well over twice as much in a number of others. The overall average is not given, but would probably be rather over a penny-halfpenny. The significant point about this paper, however, is not the actual rates resulting from the calculations but the difficulty which was experienced in arriving at them. The information supplied in the tariff schedules of some of the companies concerned was so involved, and in others so manifestly incomplete, that it was impossible—even for an expert in the subject—to arrive with any certainty at what the actual cost would be. The course finally adopted was to send all the particulars to each company asking each of them, as it were, to quote for the actual number of units mentioned, but in the absence of consumption figures, this course would not in general be open to the farmer who was considering electrification as an alternative to existing equipment. This state of affairs is clearly not good enough. Supply companies may be faced with difficulties peculiar to electricity—and some of these are very clearly explained in this paper—but in the long run they will have to fall into line with the suppliers of any other commodity. Rural electrification cannot be expected to make general progress until a simple price schedule can be quoted from which any farmer can work out the cost in his own particular case.

One other problem must be faced before electricity can actually be used—that of wiring the farm buildings. This is a relatively simple problem in the sense that in any district there will be contractors who will estimate for and carry out the work. There are, however, a number of different wiring systems—good, bad and indifferent—of which the installation costs will

vary considerably. These systems and the arguments for and against them are fully discussed by Cameron Brown (Ref. 30). Having regard to the arduous conditions which farm wiring has to face, there seems to be no doubt that the most expensive system, in which all conductors are carried in galvanized steel tubes, is the most generally satisfactory one. At the same time there are less expensive systems which can give good service if properly installed. Typical charges for different types of wiring are given in the bulletin and it is pointed out that very low estimates should be regarded with suspicion, for scamped workmanship may lead to serious trouble later on.

All these preliminary considerations of initial connection and wiring are common to all applications of electricity, and their capital cost must be taken into account before valid comparison with alternative sources of power or heat can be made. This fact is stressed in the review already quoted (Ref. 28). Nevertheless, it is also pointed out that the most promising field of development lies in those applications where convenience and not cost is the primary consideration. In dairy farming, for example, the very small power requirements of milking machines, separators, etc., are much more easily met by electric motors than by an internal combustion engine, while the greater cleanliness of electricity gives it an additional, and very great, advantage. Another field of rapid electrical development is in poultry farming, where ease and certainty of control are the most important advantages. A comprehensive booklet on this subject has just been written by Cameron Brown (Ref. 31). He states that there is no longer any question about the technical success of electrical methods in poultry farming. The possibility of current failure, which was once regarded as an objection, particularly in connection with incubators and brooders, is now not considered serious, since it can be met by reasonable precautions in practice. Except where a very cheap supply is available, a certain amount of management is necessary if costs are not to be excessive, but at anything below 1¼*d.* per unit electricity should be able to compete with oil for cabinet incubators. For rearing on a large scale, electricity must be available at not more than ¾*d.* and even then automatic control is a desirable feature. In one sense electrical operation may be said to be almost too efficient, for there is a tendency to hatch out more chicks than with ordinary methods, including some which ought not to survive. This can, of course, be met in practice by drastic inspection and culling.

Another application said to have shown a handsome profit during an experimental season is in providing artificial lighting for laying birds.

VI.—Grassland Implements.

Over a whole range of applications, from the rejuvenation of old pasture on the one hand to the reclamation of more or less derelict rough grazings on the other, very great interest is being taken at the moment in the mechanical treatment of grassland. To some extent, no doubt, this interest is a consequence of the introduction of the tractor, for much of the work that is being done would be beyond the capacity of normal horse teams. To a much greater extent, however, this interest, and the implement development which is one of its main features, are the direct outcome of more general grassland research. Some Scottish work on mechanical treatment, for example, was undertaken because in the course of manurial experiments on rough hill pasture certain types of herbage did not respond as they should have done to applications of phosphates (Ref. 32). It was noted that in these areas the soil was covered with a tough mat of partially decayed plant remains and it was suggested that this interfered with the penetration of the manure so that its action was restricted to the encouragement of inferior surface-rooting plants. In further experiments, therefore, attempts were made with various implements to destroy this surface mat as a preliminary to the introduction of new species of plants. Two types of cultivator—one with compensating tines and one with spring tines—and Pitchpole and disk harrows were the four types of implement tried, each being pulled by a 20 h.p. track-laying tractor. The plots on which these treatments were tried were characterized by abundance of *Nardus stricta*, and destruction of this growth was one of the main objects of the mechanical treatment. For this purpose the disk harrow was the most successful tool, for subsequent botanical examination showed that it left only from a half to a quarter as much *Nardus* as did the others. It was also the most successful in providing a good tilth for re-seeding and the best plant of Yorkshire Fog followed its use. Both cultivators were fairly successful, although they tended to rip out the mat in large clods which resulted in a a very rough surface. The Pitchpole harrows were a comparative failure since they left parts of the mat unbroken and did not expose sufficient bare soil to provide a seed-bed.

In the foregoing work the torn-up mat was left to dry and rot where it lay. In the case of the Cahn Hill Improvement Scheme (Ref. 33, 34), on the other hand, the disposal of the torn-up mat is regarded as a major problem. The mechanical part of this work appears to be directed at finding a cheaper alternative to ploughing and complete re-seeding. One solution has been to hack up the surface mat in fairly large clods with a rotary cultivator, but this leaves, as an additional problem, the drying out of the clods and their collection for burning. For

this purpose two road-contractors' tools have proved surprisingly effective—an ordinary rotary street brush for the lighter material and a rotary road scraper for turf. In many cases there is no need to cut all the turf, and if the top inch or so can be destroyed the peaty mass of decaying roots which remains provides an ideal seed-bed. In practice this proves difficult to achieve and as a rather less effective alternative various "scratching" methods, using different types of harrows, have been used. Denham (Ref. 35) describes a number of these implements and also some home-made ones which have been successfully applied.

On the whole, grassland-cultivating implements tend to fall into three classes: those whose object is to tear up as much as possible of whatever growth may be present; those primarily intended for rejuvenation of pastures which contain a considerable proportion of valuable growth; and finally those which, like the home-made implements mentioned above, are intended only to provide an intermittent surface tilth on which new species can be sown. In the first class of implement the main considerations are strength—for they are subject in practice to enormous strains—and freedom from choking. They should treat all the ground alike and, if possible, leave the top growth in a convenient state for subsequent removal. So far no special implements of this kind have been produced, possibly because their main application is in the reclamation of hill grazings which is still in the experimental stage. Effective use, however, has been made of a whole range of ordinary arable implements, sometimes specially strengthened for the work.

On the second class of implement—the pasture rejuvenator—designers have exercised a great deal of ingenuity and several quite new devices have appeared during the past year. One of these is illustrated in the paper last referred to, while several descriptive accounts have appeared in other publications (Refs. 36–39). In theory these implements should be discriminating in their action—they should tear out moss and inferior herbage while leaving the better-quality grasses unharmed—and they should also be non-choking. In action they are all very similar although their mechanisms differ considerably. Their rather blunt straight tines are given an intermittent raking action so that they make a series of shallow scratches in the ground, and are lifted out automatically at frequent intervals so as to free themselves of debris.

For the third type of grassland cultivation it appears that each user devises his own implement. Practically speaking anything that is heavy enough to bear firmly on the surface will do, provided that it has at least one straight and fairly sharp edge in contact with the turf. It should be attached to

the tractor by rather long chains with the scraping edge on a slant so that it will swing out of the way of obstructions.

Although most of the grassland improvement so far undertaken aims at producing better pastures, this work is likely to have a much wider application when the utilization of artificially dried young grass becomes more general. The pioneer work in this direction at Cambridge and elsewhere has been summarized by Woodman (Ref. 40). On the engineering side there are the problems of collecting and drying the cut material. Two papers mention machines for collecting both really short grass (Ref. 41) and longer material (Ref. 25). The latter reference is to the Norfolk farm on which 2,000 acres of lucerne are grown for drying and conversion to lucerne meal, and an account of the cultivations necessary to keep the plant free from weed is also given.

In regard to haymaking proper there have been no new developments during the past year. A further account from America of the working of the Combine Baler (Ref. 42) records further progress resulting from additional experience but does nothing to suggest that the method is likely to become at all general. By comparison with ordinary methods of hay carrying, combine-baling is definitely slow, and since the limiting factor is the speed at which one man can tie bales, it cannot be speeded up very much. Slowing-up of harvesting, whether the actual labour expended per ton of hay is reduced or not, means an increased risk of damage from unfavourable weather and cannot be tolerated, in this country at any rate. Baling in the field with a standard baler, on the other hand, is becoming increasingly common and there is scope for the introduction of a simple self-feeding attachment to save some of the labour at present required.

VII.—Row-crop, Market-Gardening and Spraying Equipment.

During the last few years the dividing line between market gardening and ordinary arable farming has become less clearly defined, and it is becoming increasingly common for arable farmers to grow vegetable crops of various kinds. In some cases this is due to the fact that certain of these crops happen to fit conveniently into the labour time-table of the fully mechanized farm. In other cases it is due to the experience gained with sugar beet as a cash crop to replace the traditional fodder roots. In either event tractors are generally used for the ordinary work of the farms concerned, and must necessarily be used as far as possible on any new crop that is undertaken. A paper by the present writer (Ref. 43) describes some of the newer implements for row-crop and vegetable cultivation. Up to the time of sowing

or planting nothing is required that is essentially different from the tractor implements used in ordinary work. Rather deeper working may be necessary and, since the plots will often be relatively small, there may be an advantage in using a small, easily manœuvred tractor. Hoeing is the chief operation in which new equipment is necessary if the work is to be done with the small amount of labour generally available, and it is here that a definite advance has been made. Although the various two-wheeled market-garden cultivators have done excellent work on large-scale holdings, and there is sometimes a case to be made out for maintaining them for hoeing alone, most farmers wish to make use of attachments to their ordinary tractors. Several forms of directly attached steerage-hoe equipment are now available. They require two men—one driving the tractor and one controlling the hoes—but since the second man is provided with a seat, speeds of three miles per hour are common and a considerable acreage can be got through in a day. In most cases the steerage movement can be locked so that the equipment can be worked by one man alone when very close work is not required. An alternative type of equipment, requiring one man only, is rigidly attached to the front of a tracklaying tractor. This type is not common but has been used effectively on at least one farm which grows a very large acreage of vegetables (Ref. 25). The application of tractor row-crop equipment is, of course, not limited to hoeing. In particular most makers also provide a very complete range of attachments for potato work. One essential in all tractor row-crop work is that the tractor shall accurately fit the particular row widths used. At one time this was a source of much difficulty because growers were unwilling to change the widths from those to which they had been accustomed in horse work. The difficulty is not so serious nowadays, both because growers are less conservative and because tractors with adjustable wheel tracks are becoming more common. A paper by Newman (Ref. 44) discusses the relations between row widths and tractor dimensions, and gives tables which will help the non-mathematical farmer to decide with what widths of row his own particular tractor can be used. The real subject of this paper is sugar-beet harvesting, but most of the conclusions about row widths will apply to any row-crop operation. The other subjects dealt with are combined lifting, cleaning and loading machines, the transport of beet from the field, and an analysis of the essential features of mechanical topping devices. Combined lifting machines have not yet made much headway, although some of the more recent ones work fairly well on easy-working soil which is free from stones. One of these machines is fully described in another article (Ref. 45) and an account of its working in an English trial is given.

On the more intensive side of vegetable growing a paper on irrigation by Secrett (Ref. 46) is of interest. The greater part of it deals with what may be called the husbandry of the subject, but it also gives particulars of the equipment used. Irrigation is of two distinct kinds—the heavy watering used as a preparation for planting or drilling, and a lighter treatment which aims at stimulating a growing crop. In the former type of irrigation the manner of applying the water is perhaps not so important as the subsequent cultivations which aim at conserving and using it to the best advantage. Not all water is suitable, and water drawn directly off clay is to be avoided. In the overhead irrigation of growing crops, on the other hand, the water must be thoroughly atomized and the more the application can be made to resemble mist rather than heavy rain the better the result. The spray lines are portable and are set up at intervals of 40 feet. Nozzles are provided at 2-foot intervals and the pipe is rocked to and fro automatically while the watering is being done. The whole system is supplied by a centrifugal pump capable of delivering 150 gallons per minute, driven by a 30-h.p. diesel engine; and the outfit includes an aeration plant and a "solutionizer" for adding small quantities of fertilizer.

Irrigation of another kind is mentioned, in a paper on glass-house heating (Ref. 47), as having been tried in Germany. The water in this case was waste water from the condensers of a power station and it was used for the purpose of soil heating rather than watering. About 10,000 gallons of the warm water were passed per hour through each of eight trenches which traversed a three-acre strawberry plantation, and on cold nights the resulting vapour formed a thick mist over the plantation which provided a most effective protection from frost. Two other trial methods of utilizing waste warm water are also mentioned as possible alternatives to ordinary methods of greenhouse heating—the idea being that while market gardeners are using expensively produced heat to warm their hothouses, power stations and similar undertakings are throwing vast quantities of hot water away every hour.

A systematic investigation on spraying machinery is being carried out at Wye College and two sections of the work, both dealing with nozzles, have been published (Ref. 48, 49). The first of these reports describes the methods which have been evolved for making laboratory records of the performance of any given nozzle. Two types of record are made: a stationary pattern which, in effect, illustrates the distribution of the liquid over a cross section of the cone or jet in which it emerges from the nozzle; and a traverse pattern which illustrates the distribution achieved when the nozzles are moved from side to side. This part of the work does not attempt to reach any immediately

applicable result—it aims rather at making systematic measurements which will lead to better understanding of the working of nozzles and so eventually to improvement in design. Nevertheless, one common misconception has already been exposed by the work. Users of spraying plants have long believed that in order to get a fine misty spray it is necessary to use the smallest final orifice or disk. All the experimental evidence points, however, to the fact that with the common types of eddy-chamber nozzle the degree of atomization does not depend on the size of the final orifice but only on the pressure, the depth of the eddy-chamber and the size of the vortex holes leading into it.

In the second paper a means of measuring the effectiveness of the spray in the field is discussed. Artificial leaves made of transparent celluloid are distributed at random in the trees to be sprayed. After sufficient time has elapsed for the spray to dry, these artificial leaves are collected and examined. The pattern left on them is sufficiently definite to allow them to be used as photographic negatives from which a permanent record can be printed. One difficulty in connection with the work is that there is no unanimity among entomologists and mycologists as to what type of spray is required in practice. However, the sooner distributions can be described and measured accurately the sooner will biologists be able to make up their minds, and the procedure adopted here of interpreting results, by reference to a more or less arbitrary score card, will be easy enough to vary when necessary.

Spraying for the control of arable-land weeds continues to make progress and MacDowall (Ref. 50) notes several developments that have taken place during the year. Water shortage, in particular, has caused attention to be focussed on methods, both mechanical and chemical, for making a given quantity of spray cover a larger area. Another development has been the use of sulphuric acid on potato haulm, with the double object of controlling blight and of destroying the haulm so as to facilitate lifting. This application is also dealt with in greater detail by Bates and Martin (Ref. 51).

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FARM ECONOMICS.

IF it were necessary at the outset of this digest of progress in the investigation of the farmer's business in the year 1934 to comment upon the economic position of the agricultural industry as a whole, an improved condition would be recorded. There has been no spectacular change in the position, but there is evidence of greater confidence on all hands, and this has been strengthened by the decision of the Government, since the close of the year, to continue the subsidy to beet sugar, and by the recommendation of the Committee appointed to advise upon the Wheat Subsidy.

In the following summary of the research work of the year, the results of studies of the national agricultural policy and of the marketing schemes are given first place, and these are followed by an abstract of particular investigations into the economics of farm management, with the conclusions to which they lead.

I.—AGRICULTURAL POLICY.

The progressive reorganization of the agricultural industry under the National Government, by means of protective measures of various kinds, has led one writer to consider what is the ultimate aim of a planned agriculture. It is pointed out that the situation in Britain is essentially different from that of most countries which impose high tariffs against the importation of food. In the greater part of Europe farming is mainly a peasant industry and the countries can support themselves. The peasant farmers constitute the largest element in the population, and the concern of their governments is to preserve them in their existing mode

of life. Consequently they attach less value to cheapness of food than to the maintenance of a price level at which the peasants can live. It is pointed out, however, that another situation prevails in Britain, where the interests of a great consuming population cannot be subordinated to those of an agricultural community numbering only some 8 per cent. of the whole. It follows, the writer suggests, that the country will not be content to set up a marketing board for each of the more important commodities which the farmer produces, and to assist him further with tariffs or quotas. We cannot grow all the food that we need, and so a national plan should show some discrimination between the commodities to be protected and the quantities of them for which the country can afford to pay. Agriculture, particularly, demands a long-period plan extending far beyond the life of any one Government. The real aim of the planning policy, as opposed to *laissez faire* and disorderly competition, should be to increase and cheapen supplies to the people by guiding farmers into the better methods (Ref. 1).

As if to provide a basis for scientific planning, an important publication was made towards the close of the year, comprising a study of the effects of recent legislation upon food imports into this country. Some of the results are very striking. The year 1925 was taken as a base, and changes year by year since that time are given for all imports collectively and also for each of the more important commodities, both in groups ("meat"; "dairy products"; "wheat and flour", etc.) and individually ("chilled beef"; "butter"; "flour", etc.) to the number of twenty-eight. The results are striking, and in some ways even surprising, for much more has been accomplished already in the control not only of the total quantity of imports but also of the quantities taken from different countries, than is sometimes realized. Grouping all imports together, it appears, for example, that while the total rose steadily in volume from 1925 to 1931, it fell off sharply from this year on to 1933. Until 1931 imports from the Empire accounted for some 38 per cent. of the total, but by 1933 foreign supplies had decreased so much relatively to those of the Empire that the Empire import had risen to exactly 50 per cent. of the total. Thus, the national policy had brought about not only the curtailment of total imports, but this had been achieved by the reduction of those derived from foreign countries, while increasing those from the Empire. In the commodity groups, meat imports, which had been rising steadily, have shown a progressive fall since 1931, the decline being entirely due to the reduction in foreign supplies. It will not surprise farmers interested in the dairy industry to know that the volume of imported dairy products has increased each year since 1926, the greatest part of the increase being

due to heavier exports of all manufactured milk products from the Empire. The publication must be consulted for information of a like kind upon the changes in the quantities of imports of other commodities. The authors attribute the general decline partly to the Government policy and partly to the departure from the gold standard, which discouraged imports. They remark that "in so far as the aim of the Government's policy has been to cut down imports and to give the Empire an expanding share of imports into the United Kingdom, it has been successful. The total volume of food imports has been reduced by 9 per cent. since 1931, while foreign supplies have declined 25 per cent. and Empire supplies have increased 21 per cent" (Ref. 2).

Students of the market situation for farm products as a measure of the effects of agricultural policy may be referred to an important publication by the Intelligence Branch of the Imperial Economic Committee, giving a very complete survey of world production, distribution and prices of dairy produce, eggs, egg products and poultry, bacon, pork and pork products during 1934. Figures in this year are contrasted with those of previous years, and often they make remarkable reading. There are 13 countries, for example, exporting butter in notable quantities, and when one reads that the United Kingdom takes proportions ranging from 98 per cent. of the New Zealand export to 47 per cent. of the Dutch export, the competition which the home-produced manufacturing milk trade has to encounter is readily understood. The figures for cheese are equally striking. The effect of nationalist legislation in other countries is also disclosed, the butter, cheese and egg imports into Germany, for example, all having been reduced by 50 per cent. in the last four years (Ref. 3).

II.—Marketing Schemes.

1. *Live Stock.*

The long awaited Report of the Reorganization Commission for Fat Stock for England and Wales was presented during the year. The main proposals of the Commission are grouped into three categories, namely :

(*a*) To restore remunerative prices to the live stock producers of Great Britain ;

(*b*) To establish an efficient system of marketing live stock ;

(*c*) To raise the quality level of home-produced live stock and meat.

Dealing with the problem of low prices, the Commission found that the downward course of live stock and meat prices

was closely associated with the rapid increase of meat imports in recent years. To the devastating effect of this increase was added the effect of the autumn glut of home supplies of fat cattle, a number of them badly finished. To remedy the autumn glut, the Commission could only suggest a reduction of the pressure of supplies, and to remedy the general situation it recommended the tighter regulation of imports of all classes of meat and live stock *irrespective of origin*. At the same time, the Commission expressed the opinion that the full benefit of higher prices could not accrue to the home producer without greater efficiency in the field of marketing and in the preparation of meat for sale.

To secure this greater efficiency, the Commission drafted a marketing scheme, covering both store stock and fat cattle. After reviewing the existing channels of sale, they recommend the maintenance of most of them, but the reduction of the number of selling points. Few farmers, probably, will quarrel with this. The number of the smaller live stock markets, in which genuine competition for the farmer's live stock can be said hardly to exist, has been considerably reduced in recent years, but with modern transport facilities it would be to the producers' advantage to concentrate sales still more. A more controversial note is sounded in the recommendation to apply the same practice to slaughterhouses. Large-scale slaughterhouses are proposed in centres carefully selected after the whole country has been planned and zoned by a National Slaughterhouses Commission. This would involve, of course, the closing of all privately owned slaughterhouses. The economics of centralized slaughter in the handling and processing of meat and of the by-products are stated. Following these conclusions and their endorsement of the benefits of the National Mark Scheme for beef, the Commission state their conviction that the sale of home-killed meat by grade and deadweight should receive every encouragement.

No action has resulted so far from the Report. The researches of the Commission, in so far as they are incorporated in it, contain much information, and farmers may be advised to familiarize themselves with the main recommendations and the arguments and evidence upon which they are based, so that they may be prepared to consider proposals by the Government for further help to the live stock industry which might centre round the establishment of a marketing organization such as the Commission recommends (Ref. 4).

A note of warning on the policy of restriction of supplies as a means to higher prices, which has, of course, its advocates, was sounded in a paper on the live stock situation read before the Farmers' Club. It was pointed out that there are certain

commodities, such as bread and potatoes, for which the demand is fairly steady. A fall in wheat prices or a potato glut does not materially increase consumption. Conversely, demand is not easily discouraged by a rise in the prices of these commodities. It follows that a bad year for potatoes, for example, is often a good year for potato growers. For some other products, however, the demand is known to be highly elastic. A rise in price is immediately reflected in a reduction of consumption, while a fall in price immediately stimulates it. Most live stock products are in this category, for, broadly speaking, people eat bread and margarine when they must, and bacon and eggs, or chops and steaks, when they can. Thus, while potato growers may very well succeed in getting satisfactory returns by withholding from sale a part of their crop in a glut year, even though it be wasted, it would be no solution of the problem of low meat prices to send bullocks to the manure works instead of to the butcher, or of the problem of low egg prices to keep back a percentage of eggs for the next General Election. These statements are supported by tables of figures for prices and consumption, and the problem is one which must have serious consideration in the formulation of live stock marketing schemes (Ref. 5).

Turning now to pigs, it is probable that the operations of the Pigs Marketing Scheme are well understood. The attention of pig feeders may, however, be directed to a statement of them by the Chairman of the Board, and more particularly, perhaps, to the discussion following it, which contains much constructive criticism (Ref. 6).

2. *Eggs and Poultry.*

The Report of the Reorganization Commission for Eggs and Poultry was presented during the year, and has provoked much discussion. So far, however, no marketing scheme has resulted from it. The Report has two principal sections, one dealing with the marketing of eggs and the other with poultry marketing. Referring first to eggs, the proposals of the Commission are that the whole of the country should be divided into a number of areas for the collection of eggs, each based on a packing station. The size of the areas would vary with the intensity of egg production in different parts of the country, the object being to enable each packing station to operate with the maximum of efficiency. Similarly, the country, apart from London, would be divided into regions for the purpose of distribution. The object of this dual organization is to reduce the cost of collection, grading, packing and distribution to a minimum. A national price is proposed for each grade of eggs, and producers will receive for all of them the same delivered price, subject to deductions for expenses incurred by their area packing stations

for the cost of handling *and delivery.* The effect of this would be that whereas all buyers would be buying at the same delivered price, producers' receipts would vary with the amount of the transport costs incurred by their packing stations. Thus, there is every inducement to the packing stations to satisfy the market within their own areas before selling further afield, so that transport costs would be reduced to a minimum and the maximum of efficiency would be secured. Provided that the area packing stations comply with the conditions laid down by the proposed Eggs Marketing Board, the Commission express themselves as being indifferent to whether the stations are privately, co-operatively, or trade owned, the reason given being that they do not wish to interfere with existing private and trade-owned organizations. This, perhaps, is a weakness of the scheme. It is difficult to see how the stations can be operated in the highest interest of producers unless they are producer-owned.

Considering the marketing of table poultry, the recommendations of the Commission reached a less definite position. They were clearly impressed by the complexity of the business, and they considered that it would be "impracticable to aim at the immediate introduction of a complete national scheme of assembly and distribution." The suggestion is that when the marketing of eggs has been organized on the lines recommended, a plan comparable with it should be introduced for the marketing of poultry.

Poultry keepers should familiarize themselves with the contents of the Reorganization Commission's Report. It contains much information upon supplies and prices, together with a valuable survey of the existing channels of distribution (Ref. 7).

3. *Fruit.*

There has been no Reorganization Commission appointed to report upon the marketing of fruit. The National Farmers' Union felt that in the Ministry's Report on Fruit Marketing (Ref. 8) and in the body of information available to its own Fruit, Vegetables and Flowers Committee, through the intimate knowledge of the wholesale markets possessed by the members, sufficient material existed for the formulation of a Marketing Scheme without further inquiry by a specially appointed Commission. Accordingly, the Union proceeded with the preparation of a scheme without this assistance.

The scheme provides for the administration of the whole of the fruit industry under one Marketing Board, though each class of fruit would have a separate Advisory Committee appointed by the Board, all classes of glasshouse fruits being considered as one for this purpose. Its provisions, however, have not received

a sufficient measure of support in the principal fruitgrowing districts, and there is no immediate prospect of further action. The draft heads of the proposed scheme, together with an explanatory memorandum, were published during the year by the National Farmers' Union (Ref. 9).

4. *Sugar Beet.*

The continued cultivation of sugar beet in Britain has been a matter of much controversy during the past year. Owing to a variety of circumstances, of which the fall in world prices for sugar is the chief, the British sugar-beet industry has not been able to establish itself upon an economic basis during the original period of Government assistance, and in April, 1934, a Committee was appointed to make recommendations for the future of the industry. It is a matter of history, now, that two members of the Committee reported against the continuance of State aid, while the third member presented a report dissenting from this view (Ref. 10).

The Farmer's Guide, however, is concerned not with controversy but with research, and it is sufficient to say that the Government has not accepted the majority recommendation, but has decided to continue to assist the home-grown sugar industry by giving it the financial support without which it could not go on. The old policy, however, of subsidizing unlimited production is to be abandoned, and for the future the production of beet sugar is to be stabilized on the basis of 560,000 tons of white sugar, which is estimated to be the produce of 375,000 acres of sugar beet. In the sugar season 1934–35 the production was 602,000 tons of sugar, so that future production is to be stabilized at a reduction of 42,000 tons of white sugar on last year's figures, equivalent to an acreage reduction of 28,000 acres of sugar beet. The proposals of the Government are available for examination by those concerned in a White Paper (Ref. 11).

Those interested in the economics of sugar beet growing in this country will find a full summary of growers' experiences during the first ten years of the Government subsidy in a Report issued by the Agricultural Economics Research Institute, Oxford. The collaboration of other research workers in the beet growing districts of Britain was secured, and the compilation, year by year throughout the period, of records of methods of cultivation, manuring, harvesting and transport was undertaken. These records are set out in relation both to soils and to districts, and tables of costs and returns have been compiled upon the same basis. There is a discussion of the place of beet in the farming rotation, and statistics are given showing what crops it has displaced and the extent of this displacement. Crop yields are

recorded in the different districts and on different soils, and there is a discussion of the value to the farmer of the by-products of beet growing for the sugar factory, the tops and leaves.

The Report is a record of steady progress in the cultivation of a new crop. Labour costs, for example, which averaged £11 9*s*. 10*d*. per acre in 1924 had been reduced to £8 5*s*. per acre in 1932, while a total farm cost, averaging £21 12*s*. 3*d*. per acre in 1924, had fallen to £15 0*s*. 8*d*. per acre in 1932, a striking record of increasing efficiency as experience in handling the new crop was gained. During the same period the gross returns to the grower fell only from £25 18*s*. 3*d*. per acre to £24 0*s*. 7*d*. per acre. To avoid any misunderstanding, it should be noted that the difference between the farm cost and the gross returns had to provide for transport costs, costs of management and interest on growers' capital, as well as for profit. The figures refer to a varying acreage of beet, but the sample, which was as high as 5,471 acres in 1927, may be regarded as sufficient to give a fair measure of the general experience. Amongst the reasons given for the steady reduction of costs are the following :—

(i) The increased experience of growing beet leading to better organization of the work.
(ii) A more satisfactory supply of labour in most districts.
(iii) Greater skill on the part of the workers.
(iv) More piecework, reduced rates of pay, combined with bonuses to workmen for good work.
(v) Reduced horse labour costs, following the fall in the prices of foodstuffs.
(vi) The extended use of mechanical power.
(vii) Changes in the place of beet in the rotation. By growing beet after fallow crops, cultivations for the seed bed have been reduced.
(viii) Improved methods of spacing the plants, such as cross-gapping and the use of spacing drills.
(ix) Reduction of lifting and haulage costs by concentrating on lifting in good weather and dumping the roots near a hard road.
(x) The more efficient use of artificial manures.
(xi) The ameliorating effects on the soil of the crop itself.
(xii) Reduction of rents.
(xiii) Reduction of contract rates for transport owing to greater competition amongst contractors.
(xiv) The concentration of beet growing on soils most suited to it.

The writers conclude with some figures of sugar-factory incomes, costs, and trading profits, and with some observations on the future of beet growing in this country (Ref. 12).

III.—Farm Management.

1. *Economic Surveys.*

(*a*) *Eastern Counties.*—Another survey (the third of a series) of agricultural experience in the Eastern Counties has been issued by the Farm Economics Branch of the Department of Agriculture, Cambridge. It relates to the year 1933. This summary of the information collected is presented in tabular form, under a classification of farms by size groups. Thus, much light is thrown upon the differences in the farmer's business, following the size of his holding, and the results are of considerable interest. Contrary to general opinion, corn farming bulks just as large in the small holder's business as on the more extensive holdings, but it must be remembered that these are small holders in the district which might be termed the English corn belt. On the other hand, the distribution of the farming capital shows the importance of cows and pigs to the small man with an almost entire absence of sheep, while cattle and sheep are the mainstay of the large farmer's live stock business. The importance of the Wheat Deficiency payments to these Eastern Counties farmers is very clearly brought out. Out of an average net farm income of £680 on farms over 500 acres in extent, no less than £466 was due to the operations of the Wheat Commission. The figures for farms of all sizes reflect a return of prosperity to the land, when the results are contrasted with those yielded by the survey of the previous year.

In the second section of the Report there is a detailed description and analysis of some individual farms, divided into two groups, the first being profitable and the second unprofitable. The reasons for success or failure on each holding are considered and they afford instructive reading.

The Report concludes with the results of some miscellaneous inquiries made at the time of the survey—the average age of farmers (2 per cent. of the occupiers of farms of twenty to fifty acres were under twenty-five years of age, but there were none so young on farms over 300 acres); the number of years' experience as a farmer (only 15 per cent. of the small holders had twenty-one years' experience or more, but 50 per cent. of the occupiers of holders over 300 acres had been farming for this time); the vocational experience of farmers (some 20 per cent. of those farming 100 acres or less were drawn from other businesses, but only some 10 per cent. of those farming over 150 acres); the places of origin of Eastern Counties farmers (40 per cent. of those in South Hertfordshire were born outside the Eastern Counties, but only 3 per cent. of those in central Norfolk). And it may interest the Director of Talks at Broadcasting House to know that whereas farmers large and small are interested in

practical talks and announcements of market prices, talks on scientific subjects, and particularly on economic subjects, arouse little enthusiasm (Ref. 13).

(*b*) *Devon and Cornwall.*—Two Reports have been issued from the Department of Economics, Seale Hayne Agricultural College, on the financial results of certain farms in Devon and Cornwall in the years 1932–3 and 1933–4. The work has been going on now for ten years, and these Reports include an analysis of the financial accounts of about 100 farms. As in the Cambridge Survey, these figures from the other side of England reflect the improvement in agricultural conditions, the value of the output of everything except cattle showing an increase in the last year. On the other side of the accounts, the cost of labour was reduced in 1933–4 on 61 per cent. of the farms, the average saving on all farms being £3. On the other hand, there was an increase in the expenditure on manures of £7 per farm, while the expenditure on feeding stuffs showed an average increase of £21 per farm. Total expenses in 1933–4 increased by an average amount of £29 per farm, and this in itself is an indication of rising prosperity.

The net results of this analysis of farmers' books are given in geographical divisions, and it is interesting to note that the best results are those of the dairy farmers west of Truro, and it is here, no doubt, that the Milk Marketing Board finds some of its strongest supporters.

Perhaps the most significant fact in this Report is the association of good returns with a high output. The West Cornish farms have a net output of about £7 5*s*. per acre, whereas the least profitable farms are a group in which the net output was rather less than £2 an acre. There is no denying the application of the Law of Diminishing Returns in farming, but it is quite certain that there are farms on which production could still be pursued more intensively with good results. The depletion of many farmers' resources in working capital, however, is the practical difficulty (Ref. 14).

Another Report from the same centre deals with the labour requirements of crops and stock. It is an attempt to provide standards by which any farmer in Devon or Cornwall, following the conventional farming system of his district, may measure the efficiency of his labour organization. The figures forming the basis for the calculations were collected during the seasons 1930–31 and 1931–32, and they cover all the crops of the district, including cider apples and grassland, all the live stock, labour on the maintenance of the holding, and horse labour. The actual figures, of course, have only local application, but they should be studied by those whom they concern (Ref. 15).

(*c*) *Scotland.*—From the Department of Agriculture for

Scotland comes a Report of a survey of small holdings in 1934. In this country the family farmer is of more economic importance, probably, than in most districts of England, but students of land settlement problems will find much in this survey to interest them, even though judgment must be exercised in the application of Scottish results to English conditions. It is stated, for example, that all the evidence points to the fact that small holdings are not so well adapted to mixed farming practice as to the more intensive forms of production. But this generalization would need some amplification in England to-day, where poultry farmers and market gardeners, for example, are reported to be doing none too well. Nor do the figures in the Scottish Report justify its conclusion quite literally. While the specialist poultry holdings made average profits of £307 and net earnings per family worker of £255, and similar figures for the producer-retailer dairy holdings were £231 and £152, the market gardeners' figures were £63 and £59 and the specialist pig-producers' figures were £114 and £80 respectively. Mixed holdings with live stock, on the other hand, earned profits for the occupier of £105 per holding, with average net earnings per family worker of £90. Out of 201 holdings of all sorts, only eleven incurred losses, and on the remainder the average family earnings ranged from nothing to £50 on thirty-one farms, up to £500 and over on five farms, four of which were dairy holdings and one a poultry holding.

The figures quoted are averages for all districts. The Report itself must be consulted for their details (Ref. 16).

Another Report from the Scottish Department, published in 1934, deals with the financial results obtained on certain groups of farms in 1931–32 (Ref. 17).

2. *Crops.*

(*a*) *Corn Growing.*—The world wheat position is a matter of much less moment to the British farmer to-day than it has ever been, but notwithstanding the Wheat Act the situation cannot be regarded as satisfactory so long as the gap between world prices and farmers' costs is so wide. Some interest, therefore, attaches to a short report published by the Harvard Economic Society on the influence of planned policies on production. The conclusion is that the International Wheat Agreement of 1933 and national policies aimed at the restriction of production have exerted little influence upon the current situation. The writer sees nothing in the immediate outlook to suggest that the maladjustments in the world wheat situation will be corrected in the near future to an extent which would bring about a material price recovery in the wheat-growing countries (Ref. 18).

In a review of the costs and financial results of corn growing during the years 1924 to 1932, in the South Eastern Province, the writer gives many figures for the expenditure upon the production of wheat, barley and oats, but it is, perhaps, in his discussion and interpretation of the results that the real interest of the work lies. The farmer must consider first, he says, whether he should grow corn at all, and if he decides to do so he must next consider how it should be grown. Should he continue with one of the established rotations of his district, or should he follow some of the corn-growing specialists and evolve a system in which everything is subordinated to corn growing? With these questions settled, there still remain the technical problems on any farm; there is a certain minimum cost per acre which must be incurred to grow a corn crop at all, and experience shows what yield can be expected from this. The problem is how to increase that yield, by cultivations, manuring or in any other way, so as to increase the net returns (Ref. 19).

(*b*) *Potatoes.*—In 1932 workers at the Midland Agricultural College began an investigation of potato production and marketing in the Counties of Lincolnshire, the Soke of Peterborough and the Isle of Ely. The investigation was carried out by soil types as well as by varieties, and it was continued for two years. Some 300 growers with a potato area of 3,500 acres were costed in the first year, and 188 growers with 2,000 acres in the second year. An important feature of the analysis is the calculation of the normal cost of each operation on the crop under each of the soil types. The maincrop potatoes, earlies and first earlies were studied, and the returns are considered under field costs, supplementary costs and marketing costs. It was found that about 30 per cent. of the seed planted each year was bought direct from Scotland, but that seed once grown generally yielded better than Scottish seed. King Edward was found to be more susceptible to blight than Majestic, and dressing costs varied from an average of 5*s*. 8*d*. per ton of ware for King Edward in 1932 to 2*s*. 9*d*. per ton for Majestic in 1933.

The costs per saleable ton of all maincrop potatoes was £3 14*s*. in 1932 and £3 in the following year. Both years experienced glutted markets, but good samples of King Edward sold readily notwithstanding.

Midlothian Early accounted for nearly two-thirds of the crop of first earlies and gave the highest gross return. Eclipse, 20 per cent., and Sharp's Express, 12 per cent., were next in order of preference. An inquiry amongst some 1,500 consumers showed a preference of 60 per cent. for King Edwards, no other variety being named. There was a marked decline in the consumption of potatoes per head as the income of the consumer rose, and a greater choice of foodstuffs became available. This

inquiry amongst consumers was conducted in the country town of Brigg and the industrial city of Nottingham (Ref. 20).

(*c*) *Strawberries.*—For the past four years the financial results of strawberry growing in the Southampton area had been under investigation by Reading University. The Fourth Report deals with the crop in 1934, and with the experience of forty-one growers with a total acreage of 121. These men are the typical small cultivators of the district, only eight of them having more than four acres under crop. Sales averaged just over one ton per acre, and the net receipts after meeting all charges except the family labour averaged £32 7*s*. 7*d*. per acre (Ref. 21).

3. *Live Stock.*

(*a*) *Diseases of Cattle.*—In 1932 the Prime Minister appointed a Committee of the Economic Advisory Council to consider what practical measures could be taken to secure a reduction of disease amongst milch cattle, with particular reference to a reduction of bovine tuberculosis. The Committee continued their investigations for two years, and their Report summarizes the latest scientific information upon the production and distribution of milk in relation to cattle diseases and public health. The Committee concluded that the milking life of a dairy cow is no more than half that which it might be, with a resultant loss to the nation of more than £3,000,000 per annum. Fifty-eight per cent. of the cows passing out of herds are disposed of on account of disease, bovine tuberculosis, contagious abortion, mastitis and Johne's Disease. The measures recommended for the eradication of disease concern the veterinary scientist more than the farm economist, but the administrative and financial aspects of the Committee's recommendations should be of general interest. They recommend that the farming community should be responsible for the costs incurred in the eradication of disease, with loans repayable over a reasonable period to assist them in this work when necessary; that the milk industry as a whole should find the sum needed to pay the bonus on milk from accepted herds; that the costs of increased veterinary services and of free tuberculin testing should be borne by national or local funds. Further, that there should be a substantial grant from the Government to help in the eradication of tuberculosis, and that compensation to owners of tuberculous animals slaughtered under the tuberculosis order should then cease. The recommendations may be compared with the Minister of Agriculture's proposal for cleaning up the dairy herds, and the Report as a whole is a document of first class importance (Ref. 22).

(*b*) *Dairying.*—Two Reports of investigations on the economy of feeding for milk production were issued during the year, the

one covering a group of farms in the Blackmore Vale, and the other dairy farms in the adjoining county of Wiltshire. Combined work on this problem has been organized at most of the Advisory Centres, and it originated in some work on the importance of grassland improvement undertaken by the Advisory Economist at Manchester. Many farmers to-day are familiar with the "starch equivalent method" of estimating food values. Now, the theoretical requirements of starch equivalent per cow are known, and they are supplied partly in the form of grazing and partly in the form of purchased and home-grown foods other than grass. But whereas the cost of starch equivalent contained in purchased foods is about 1*d.* per lb., that in the form of grass is about half this figure. Thus, the advantage of utilizing the grassland to its fullest extent in the maintenance of the dairy herd is obvious, and some results of the Manchester work, not yet published, indicate that, on some farms at all events, an increase in herd numbers and a reduction of milk costs can be secured by careful treatment of the grassland and greater attention to its grazing. This, and other matters, are dealt with in the two Reports under notice (Refs. 23 and 24).

From the South Eastern Agricultural College comes a review of the costs and financial results of milk production in the South Eastern Province between the years 1928–29 and 1932–33. On a total production of 1¾ million gallons of milk on twenty farms there was an average net return of 2½*d.* per gallon, or £6 per cow, without allowing for interest on capital or the farmer's services as manager. These results were secured on an average wholesale price for milk of 1*s.* 3½*d.* per gallon and an average yield per cow of 604 gallons per annum. An analysis of the total cost shows that labour accounted for 22½ per cent., foodstuffs 53½ per cent. (after an allowance for residues), herd replacement 10¼ per cent., sundry items 9½ per cent., and delivery 4½ per cent. The writer draws attention to one important factor in the efficiency of milk production which is not always recognized, namely, the services of the cowman, and he suggests that there seems to be a real need for some organization by which cowmen could be given some training in the principles of good cowmanship. For example, many cowmen to-day co-operate readily enough in keeping reliable milk records, but in how many cowsheds is feeding regulated with any accuracy according to these records? The farmer may ration the herd, but the rationing of the individual cows is in the hands of the cowman (Ref. 25).

(*c*) *Sheep.*—Less work has been done probably upon the economic problems of sheep farming than upon many other branches of the farmer's business. This is surprising, considering how important the flock is on so many farms, and considering

the great changes that are manifested in recent years in this branch of husbandry. Much is heard of the decline in the numbers of hurdle sheep and of the growing importance of the grass breeds of the hill districts. But there is little information, either statistical or financial, to illustrate and to explain the changes that are said to be going on. A Report from the Edinburgh and East of Scotland College of Agriculture, issued during the year, upon the financial results of some Border Sheep farms, is not designed to elucidate points such as these. But breeders and feeders in Northern England may be interested in these figures of their neighbours' experience (Ref. 26).

(*d*) *Poultry.*—Few things in British farming since the War have been more striking than the growth of the poultry industry, and its importance is illustrated by the attention which it has received from investigators in all parts of the country. In 1913 70 per cent. of the total egg consumption was represented by imported supplies, but by 1932 this figure was reduced to 40 per cent. Even these figures do not give the whole story of the expansion of the home industry, for between these years the total consumption of eggs increased by about 30 per cent. That the poultry industry is not altogether happy, either in the present development of production methods or in its marketing organization, is manifest, and some of the troubles were ventilated and discussed at the Farmers' Club. Both paper and discussion were naturally discursive, and they must be read to be appreciated (Ref. 27).

Few branches of farming are carried on with so much diversity of practice as poultry-keeping, but the business tends to become more and more specialized, some men concentrating on incubation and sale of chicks, others on egg production, others on fattening. Egg production itself shows a wide range of method, varying from the hen battery to the free-range flock. It follows that generalizations about the economics of poultry keeping are impossible, and readers must be referred to the published Reports of research work for the information they contain. They include an economic study of representative commercial egg farms in the North and West (Ref. 28); an economic survey of the poultry industry, with special reference to the Counties of Somerset, Gloucester, Worcester; Hereford and Wiltshire (Ref. 29); and two Reports on the cost of egg production and the financial results of some specialist poultry farms in the East of Scotland (Refs. 30 and 31).

4. *Mechanical Equipment.*

Most of the research work in the application of machinery to farm uses is summarized elsewhere, but reference may be made to a Report in the series entitled "Progress in English Farming

Systems," published by the Agricultural Economics Research Institute, Oxford, describing the stages in the mechanization of farm processes on a Worcestershire farm. The farm area extends to about 1,100 acres in the occupation of Messrs. D. and E. Bomford, and it is managed in three divisions, more or less watertight. There is a large area of clay land, managed on a corn and fallow rotation, with tractor-drawn implements, but the Harvester-Thresher is not in use, as the straw, which has a ready market, is unsaleable as it comes from this machine. There is a considerable tract of grassland supporting a large dairy herd equipped with the Hosier milking bail, while the rest of the land is devoted mainly to potatoes, strawberries, Brussels sprouts and cabbage. Some 220 acres are under market-garden crops. This branch of the business is perhaps the most instructive. By the use of a variety of most ingenious machines, most of them designed and manufactured in the Messrs. Bomfords' own workshops, the acreage thus intensively farmed has been increased year by year without either the displacement or the increase of the labour staff. All the implications of the system are not yet fully realized, but those who think that there is room for an expansion of intensive farming with market garden crops organized in small holdings would do well to study this example of large scale organization (Ref. 32).

IV.—Miscellaneous.

The future of agricultural co-operation in the distribution of agricultural produce rests largely with the Marketing Boards established under the Agricultural Marketing Acts. Trading Societies on a voluntary basis are, however, well established in most parts of the country. Whereas in England they have received little study of recent years, possibly owing to the winding up of the parent body, the Agricultural Organization Society, agricultural co-operative traders in Wales are well organized, and a comprehensive study of their operations in recent years was undertaken at the University College, Aberystwyth. Membership during the past seven years proved to be almost stationary, but total sales show a steady increase when allowance is made for the heavy fall in prices. Feeding-stuffs form the bulk of the transactions in the classification of the cash sales of fifty societies, amounting to some 73 per cent., and fertilizers, which come second in value, are only 6 per cent. Most of the societies work at a profit, and it is said that their influence in keeping the prices of the commodities in which they deal at the lowest possible economic level is considerable (Ref. 33).

The publication of "The Agricultural Register," a comprehensive summary of the agricultural history of the year 1933, including the Agricultural Marketing Commissions, Schemes and

Boards, enactments under the Import Duties Acts, prices and supplies of agricultural commodities, wages regulations and other matters, was repeated by the Agricultural Economics Research Institute, Oxford, as a record of these and other matters affecting the organization of agriculture in 1934 (Ref. 34).

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DAIRY FARMING AND DAIRY WORK.

I.—THE MILK MARKETING SCHEME.

A BRIEF account was given in last year's *Farmer's Guide* of the inauguration of the Milk Marketing Scheme, of some of the difficulties which had arisen in connection with it and of the steps which were contemplated in order to cope with these. It appears desirable that a short summary of the subsequent developments under the scheme should be included in this annual review.

The second year of the sale of milk under the scheme began in October, 1934, and the returns for each succeeding month showed that the Board were having to deal with a steadily increasing quantity of milk. Thus, in the winter months of 1933–34, the total gallonage sold through the Board averaged about fifty-five millions per month, whereas in the winter of 1934–35 the monthly average had risen to over sixty-four million gallons. Unfortunately this increase in the amount of milk dealt with by the Board was not associated with a corresponding increase in the amount sold for liquid consumption. The total amount absorbed by the liquid milk market rose

indeed, but only from forty-three and a half million gallons to forty-five and a half million gallons per month ; hence a much larger quantity of milk had to be used for manufacturing purposes. The quantity of manufacturing milk rose in fact from a monthly average of fully eleven million gallons in the winter of 1933–34 to one of eighteen and a half million gallons in 1934–35, an increase of 66 per cent. In the summer of 1934 the average quantity of manufacturing milk per month was twenty-one and a half million gallons and for the first twelve months of the Board's operations 28 per cent. of all the milk handled was used for manufacturing purposes.

These figures give some idea of the magnitude of the Board's operations, and the increase in production can be interpreted as evidence that, in the view of many farmers, the price policy of the Board has been successful.

The increase in the proportion of manufacturing milk has, however, lowered the net price which all farmers have ultimately received for their milk ; moreover, the operation of the system of inter-regional compensation levies, and the levies which producer-retailers have been called upon to pay, have caused great dissatisfaction in those regions where the major proportion of the milk has gone to the liquid-milk market. One remedy for this state of affairs is to increase the sales of liquid milk throughout the country, and various measures have been taken to attain this end.

The first of these was the Milk-in-Schools Scheme, (Ref. 1) which came into operation on October 1st, 1934. This scheme is designed to provide an increased number of school children with a third-of-a-pint bottle of milk on each school day, complete with straws, at a price of one halfpenny per bottle. This price is not sufficient to meet the cost of production, handling and distribution of the milk, but by reason of the value of milk to children, and particularly to those who are under-nourished, a contribution towards the cost is made by the Government under the Milk Act, 1934 (Ref. 2). The Milk Board allows to suppliers of school milk the sum of sixpence per gallon as distributing costs, and pays to each supplier, in addition to this sixpence and the shilling per gallon received from the children, any difference there may be between this amount of one shilling and sixpence and the monthly wholesale price of liquid milk per gallon. The number of children participating in the scheme on March 31st, 1935, was 2,875,000 and it was stated in the House of Commons that on the same date 51·5 per cent. of the children in public elementary schools were receiving milk at school, the great majority under the scheme.

It is clearly recognized that the Milk-in-Schools Scheme does not add directly to the income received from liquid milk,

but in addition to the benefit of the Scheme from the health point of view, there is good reason to believe that it will demonstrate, on a national scale, the value of milk as a food, will help to develop a "milk habit" and will thus lead to a marked increase in the consumption of liquid milk throughout the country.

The Accredited Producers' Roll Scheme.

The second measure for increasing the sale of liquid milk was the scheme to establish a Roll of Accredited Producers (Ref. 3) which came into operation on May 1st, 1935. The object of this scheme is to encourage farmers to produce a cleaner and better-keeping milk by the payment of a bonus of one penny per gallon to every producer who qualifies for a Grade A licence according to the Milk (Special Designations) Order, 1923. The bonus is paid from a fund obtained by the Milk Board from contributions on a gallonage basis by all producers.

An effort was made to introduce the scheme on January 1st, 1935, but difficulties on certain points of principle, administration and cost, arose between the Milk Board and the County Councils, who have the responsibility of granting Grade A licences under the above-mentioned Order. The main point of principle was that, while the Board's scheme was based on the idea of inducing the farmer, by means of a monetary reward, to produce a better article, the County Councils Association preferred the method of prohibiting the sale for liquid consumption of milk which did not attain Grade A standard, as recommended by the Committee on Cattle Diseases in their Report (Ref. 4). The main point of administration was that the Board's scheme required County Agricultural Organizers to give the necessary certificate as to the methods of milk production on the farm, and the Association was of opinion that this duty would lessen, if not destroy, the good relationships which now exist between farmers and the County Agricultural Staffs. On the question of cost, the scheme made no provision for assisting those counties with many cows but with low incomes from county rates, whereas the County Boroughs received the benefit in the form of better milk. These differences were ultimately adjusted, at least temporarily, and the County Authorities agreed to do their part in the administration of the scheme.

Since May 1st many farmers have improved their methods of production with a view to qualifying for entry on the Roll, and by July, 1935, the number of Grade A licences which had been issued under the scheme was 8,246. The advisory work of the County Staffs on cleaner milk production has, of course, increased, but fortunately the equipment required and the methods to be followed are well known; also (in addition to

publications issued by individual counties) the three Bulletins recently issued by the Ministry of Agriculture and entitled: "Studies Concerning the Handling of Milk" (No. 31); "Construction of Cowhouses" (No. 40) and "Modern Milk Production" (No. 52) supply all the information needed by farmers to enable them to comply with the conditions under which the licences are granted.

The bearing of the Accredited Producers' Scheme on the sales of liquid milk lies in the expectation that the consumer will be receiving, at the same price, a milk of greater cleanliness and keeping quality, and will thus be induced to increase his consumption. Many authorities have pointed out that one of the chief factors hindering the increase of consumption is a lack of any assurance that the milk offered for sale complies with strict hygienic standards. Although the scheme, as at present constituted, does not provide that all milk produced under it shall be offered for liquid sale, there is every likelihood that retailers will make a point of buying such milk and of informing their customers that they are doing so. In the course of a few years an increase in sales may be expected to result, and should this not happen there is a probability that the financial incentive in the form of the bonus will be replaced by legislation requiring that all milk for liquid consumption shall attain a certain standard of cleanliness, approximately that of Grade A milk, at the farm.

The effect of the above-mentioned schemes on the amount of milk sold for liquid consumption, and therefore on the pool price received by farmers, has as yet been negligible, and the increase in production, resulting in increased levies and lower pool prices, has given rise to so many complaints and has caused so much dissatisfaction with the mode of operation of the Milk Marketing Scheme as a whole that, in February, 1935, the Minister of Agriculture appointed a Milk Re-organization Commission for Great Britain to consider, amongst other things, the working of organized milk marketing in Britain under the English and Scottish schemes, and its incidence on production, distribution and consumption and to make recommendations for further improvement. This Commission is at work at present and its report will be of fundamental importance to all branches of the milk industry.

The Attested Herds Scheme.

For many years the Ministry of Agriculture has been urged firstly to provide a means whereby herd owners would be encouraged to eliminate from their herds all animals which reacted to the tuberculin test, and secondly, to give official recognition to herds where this health standard had been attained. In

January, 1935, the first step in this direction was taken by the issue of the Attested Herds Scheme (Ref. 5).

The scheme is in part based on the recommendations of the Cattle Diseases Committee (Ref. 4) and describes (1) the facilities provided for the official certification of cattle herds free from tuberculosis, and (2) the steps to be taken by the owners of such herds in order to obtain an official Certificate of Attestation from the Ministry of Agriculture, entitling the herd to be added to the official Register of Attested Herds and to the other benefits of such registration.

An owner of a herd may apply for attestation provided no reactors have been found in the herd at the two previous tests. The Ministry then carries out an official test of the herd, including stock of all ages, free of charge; if all pass, and the premises generally are approved by the Ministry's inspector, a certificate of attestation is granted. Owners of attested herds who sell their milk through the Milk Marketing Scheme will receive a bonus of one penny per gallon. This bonus is provided by the Government under section 9 of the Milk Act, 1934, which enacts that the Minister of Agriculture may "expend out of moneys provided by Parliament such sums as he thinks fit, with the object of securing so far as practicable that the milk supplied for human consumption in England or in Scotland, as the case may be, is pure and free from the infection of any disease."

The scheme was welcomed in principle, but has, so far, met with very limited success. Critics have pointed out that a herd can become attested only after the owner, by his own efforts, has freed it from all reactors; and that until some assistance is provided for those who have not yet attained this end, progress will be very slow. Unfortunately also, the small amount of the bonus, in relation to the expenses and risks involved, is detrimental to the success of the scheme.[1]

Some confusion has arisen through the names given to the Accredited and Attested Schemes. In recent veterinary articles in this country and in American reports the term "Accredited" has been used to describe a herd free from tuberculosis. In England for some years the term has been used to describe herds where the hygienic quality of the milk was supervised by the County Agricultural Authorities but where the herd was not necessarily free from tuberculosis. "Attested" is a new word introduced by the Ministry of Agriculture and has the same meaning as "Accredited" in America.

[1] An official statement was made in August, 1935, that so far only thirty herds had become attested, and that amendments to the scheme, to provide for assistance to herds which were nearly but not quite free from reactors, were under consideration.

In previous issues of the *Farmer's Guide* (1931, p. 40; 1929, p. 37 and 1927, p. 36) particulars were given regarding the formation and maintenance of tubercle-free herds, and the Ministry of Agriculture has also issued recently two advisory leaflets on this subject (Ref. 6 and 7).

Dairy Cattle—Breeding, Type and Management.

Improved Breeding Methods.

The increased attention given in recent years to methods of breeding for milk production has been maintained during 1934, and there are indications that the interest will be intensified during the next few years.

In all countries during the last twenty-five years records of milk yield and fat percentage have been largely used by breeders of dairy stock in the selection of both cows and bulls, and this practice has undoubtedly contributed to the improvement which has been brought about in the average output of our herds. At least it can safely be said that the use of records has provided a means of accurate measurement of the output of individual cows and has supplied standards whereby we can judge whether the yields obtained are satisfactory or not.

A marked development of the science of genetics has also taken place during recent years and we are now beginning to get a little accurate knowledge of the mode of inheritance of some of the numerous good and bad characteristics of our cattle.

One of the problems which confront breeders is how to make the best use of the information which milk recording and the science of breeding have placed at their disposal, and numerous articles have been written to show what practices should be followed. Recently an American writer has published a book on "Breeding Profitable Dairy Cattle" (Ref. 8) which challenges some of our popular opinions and contains many helpful suggestions about breeding methods for the future.

The author—E. Parmalee Prentice—has studied dairy stock in many countries and owns a dairy herd and farm at Mount Hope, Massachusetts, where much research has been carried out into breeding methods. He states that the purpose of his book is "to do for agriculture in the twentieth century, by the application of the new knowledge of inheritance, as much as was done in the nineteenth century by the invention of agricultural machinery." He emphasizes the high proportion of farm income which is derived from milk and milk products, and points out that the average annual yield of milk of American cows is low (4,500 lb.) and that by improved breeding methods the average can be raised to twice its present figure. The average yield of English cows is given as 462 gallons (Census of Agricultural

Production, 1931) and no one will deny that any methods which would raise this by even 50 per cent. are well worthy of study and, if found to be commercially economical, also worthy of adoption.

In the first part of his book, the author gives an interesting historical account of the growth of dairying in Europe and states that there have been four distinct periods in the development of dairy cattle. First, the time of open-field farming before 1745 when milk production was strictly limited by lack of winter food. Second, the age of Bakewell, the Colling Brothers and Bates, after 1745, when food became abundant but before the general establishment of herd books. Third, the age of pedigree breeding from the establishment of herd books to the founding of Cow-Testing Associations, *i.e.*, the introduction of milk recording. Fourth, the period now beginning, marked by the introduction of genetic methods of breeding and the use of proved good sires.

One of the most important points made is that those cows which are entered in herd books are not appreciably better, in respect of milk yield, than unregistered cows; that the possession of a pedigree is no guarantee of superior merit; and that the commercial farmer has therefore little inducement to purchase registered stock. The author summarizes this position in words which merit the attention of all Dairy Breed Societies: "So long as the Breed Associations register on pedigree alone, taking good, bad and indifferent without production records, improvement in quality is impossible." Another challenging sentence is, "If any association puts 'salesmanship' first, giving to scientific breeding a subsidiary place, it will fail to meet the demands of the dairy industry and ultimately will be superseded by another organization."

On the question of the importance of type in judging and selection it is stated that the description of many of the "points" which are considered desirable can be traced backwards through the books of early writers to the time when cattle were valued mainly for draught purposes, and that sufficient attention has not been paid to the change in type necessitated by a marked change in purpose for which the animals are kept. In this connection it is surprising to find little or no reference to the shape of the udder and to the improvements which have been brought about, especially in the Ayrshire breed, in regard to protection from injury and ease of milking. Also on the question of type as a guide to the selection of a bull, the weakness of selection by pedigree alone, or by appearance alone, is rightly stressed, but no mention is made of the importance of the type of the dam in the choice of a young bull.

The constructive portion of this book, which deserves close

attention, is that devoted to the progeny test as a measure of productive ability and the means whereby the results of a progeny test can be most simply and helpfully stated. A number of methods whereby progeny records can be tabulated and interpreted are given and discussed, and finally the Mount Hope index is given in its two forms—the "Commercial" and the "Precise." For practical purposes the Commercial form is considered to be accurate enough and it may be easily understood and simply stated. It is based on the belief that the progeny inherit equally from both parents; hence, when the average yield or fat percentage for a group of dams and their daughters by the same bull is known, the index or transmitting value of the bull can be calculated; for example—if the dams' average milk production is 8,000 lb. and the daughters' average production is 10,000 lb., then the bull has transmitted a productive ability of 12,000 lb.; similarly, if the average fat content of the dams' milk is 4·5 per cent., and the daughters' average is 4·0 per cent., then the bull has transmitted a fat percentage of 3·5 per cent.

There are numerous points[1] to be attended to in arriving at a reliable average for a group of daughters and their dams, but the above simple statement shows the principle on which the productive index of a bull can be calculated.

The "Precise" form of the Mount Hope index differs slightly from the "Commercial" form in that the milk inheritance of the daughters is taken as "seven-tenths of the way toward the higher parent, while in fat percentage they are four-tenths of the way to the higher parent." *

It will be readily agreed nowadays that the assessment of the breeding value of a dairy bull can best be made by a study of the production of his daughters, considered either alone or in conjunction with their dams' yields, but there will be more hesitation in attempting to state in definite figures the transmitting value of a bull, because other characteristics of the daughters, in addition to the yield and fat percentage of their milk, have to be taken into account in assessing their true merit. In course of time, however, the statement of bull indices will doubtless become usual, and they will certainly be most helpful in constructive breeding. In this connection Mr. Prentice's book is a most useful contribution and there is also no doubt that his criticism of the present methods of herd-book registration on ancestry alone, and of the importance attached to certain points of type in the judging and selection of cows, and particularly of bulls, must receive the careful consideration of the Dairy Breed Societies in this country as well as in America.

[1] See previous issues of the *Farmer's Guide*, 1932, pp. 4–8; *Journal of R.A.S.E.*, 1934, pp. 271–276.

An interesting illustration of the benefits to be derived from the use of progeny-test results in the selection of stock bulls is contained in a bulletin issued by the New York State Agricultural Experiment Station (Ref. 9). An account is here given of the progress of the station's herd of Jerseys since its foundation in 1900 and it is shown, by the average figures for the yearly production of butter fat per cow, that there was no improvement from that date to 1921. During this period the herd was replenished by home-bred stock and bulls or bull calves were chosen as they were required from good herds, out of good cows with satisfactory pedigrees, and were sold or slaughtered at four to five years of age; in fact, the breeding methods followed were considered to be the best-calculated to improve production. Under these conditions the average yearly output of butter fat per cow was of the order of 350 lb. There were occasional years when production reached a higher average level, but this was because some of the older cows were milked for longer lactation periods and not because of any improvement in the cows themselves.

From 1921 onwards the bulls in use were retained until their daughters came into milk; one was proved to be really good and the other was proved to be only moderate; the former was retained for another year and the latter was slaughtered. The next two bulls used in the herd were bought, as calves, after a careful study of the progeny records of their sires and grandparents. Both have proved to be very good, and the average annual butter-fat yield per cow has been raised to well over 400 lb., rising to some 460 lb. in 1931 and 1932. Apart from the greater care in the choice of bull calves for future stock bulls, the practice has been to retain those which have proved good until they were ten to eleven years of age, while more stringent selection has been applied to the cows in the herd. It is claimed that the results clearly indicate that, in the choice of bull calves intended for herd sires, more attention should be paid to the progeny of their ancestors. The calf should be the son of a proved good sire, the majority of whose daughters should show production records substantially higher than the average of the herd in which the young bull is to be used.

Progeny Recording in England.

The possibility of making improvements of similar nature and degree in English herds is by no means remote, provided that the owner will give to the choice of bulls the time and care which the subject warrants. The English milk-recording system, while still capable of improvement, gives the yields of all the cows in herds which adopt the scheme; hence the material already exists, in the annual registers, whereby the true value of

the bulls formerly used in a herd can be judged. The next stage is to group together the yields of the daughters of any one bull in such a manner that the true meaning of the records can be determined and a comparison made, if desired, with the records of the respective dams. At the instigation of the Central Council of Milk Recording Societies, the Ministry of Agriculture inaugurated, in October, 1934, a Progeny Recording Scheme (Ref. 10) whereby the progeny records of any bull used in a recorded herd can be collected for study if the owner so desires. Most, if not all, Milk Recording Societies have adopted the scheme, and it is to be hoped that a large number of members of these societies will make use of the facilities now available to enable them to understand more fully the results of the breeding methods they have followed in the past, and to plan more efficiently for the future.

III.—Milk Recording.

Progress in Britain and other Countries.

The recording of the quantity of milk yielded by individual cows is now a well-established feature of good herd management, but it cannot be claimed that the practice is as popular as it ought to be in England and Wales. It is common knowledge that many county societies have great difficulty in maintaining their membership and the *Annual Report of the Live Stock Improvement Scheme* published by the Ministry of Agriculture (Ref. 11) shows that the membership of societies has decreased by some 18 per cent., and the number of cows recorded by some 13 per cent., since 1926.

Nevertheless, milk recording, or "cow testing" as it is sometimes called, forms part of the organized activities carried out for the benefit of dairy farmers in almost every country where milk production is of importance. Recently the International Institute of Agriculture has published a lengthy article on "The Present State of Milk Recording throughout the World" (Ref. 12) and some valuable information is given on the development of the movement and the variation in the methods adopted in different countries.

At present, milk recording is practised in thirty-four countries by more than 14,000 organizations; about 285,000 farmers and stock-breeders have their cows tested and about four-and-a-half million cows are regularly under supervision. These figures show a great advance on the position of ten years ago, when twenty countries had taken up the work and less than two million cows were being tested.

The following table is extracted from the above-mentioned article in order to give a comparison between the chief dairying countries :—

DEVELOPMENT OF MILK RECORDING IN VARIOUS COUNTRIES.

Country.	Year M.R. Societies first formed.	Present Position.				
		For Year.	No. of farms.	No. of cows.	Approx. aver. No. of cows per herd	Percentage of cows tested.
England and Wales	1914	1932–33	4,598	135,902	29	4·7
Scotland . .	1903	1933	741	32,456	44	13·0
Northern Ireland .	(1921)	1934	2,544	15,050	6	6·0
Irish Free State .	1910	1934	4,186	49,052	12	4·0
Canada . .	1911	1933–34	4,351	58,571	13	1·7
New South Wales .	1912	1932–33	2,500	69,096	28	6·8
Victoria . .	1921	1932–33	3,383	109,733	32	13·4
New Zealand .	1909	1932–33	6,332	278,104	44	16·6
Denmark . .	1895	1933–34	4[illegible],9[illegible]3	701,087	14	39·6
Finland . .	1898	1931	20,456	239,069	12	18·4
Netherlands .	1899	1932	15,185	159,157	10	12·2
Sweden . .	1898	1932–33	17,803	300,855	17	14·7
Germany . .	1897	1934	75,666	135,870	2	11·2
United States .	1883	1934	13,694	335,437	25	1·3

The returns from the different countries no doubt differ somewhat in the methods by which the figures are obtained, particularly in respect of the percentage of the total cows in each country which are recorded; nevertheless the table gives a fair indication of the relative popularity of milk recording through organized societies. On this basis England and Wales falls far behind most of the other countries mentioned, and it would be interesting and helpful to have an adequate explanation of the fact.

When the prevalence of milk recording in England is studied in relation to the different counties a very marked variation is found. In 1927, for example, in Hertfordshire and Berkshire the proportion of cows recorded rose to 25 per cent., while in Cheshire and Staffordshire under 2 per cent. of the cows were recorded (Ref. 13). In 1933 the leading counties were Hertfordshire and Suffolk (27 per cent.) and Berkshire (24 per cent.), so that, in these counties at least, milk recording on a society basis has made great progress.

The popularity of milk recording in England and Wales cannot be fully measured merely by taking account of the number of herds which are included in the various county societies, because a large number of farmers keep records for their private information. In view of the small size of the average herd recorded in some other countries it would appear that the cost of official recording in these countries does not deter the small farmer to the same extent as in England and Wales, and it would therefore be useful to have a careful comparison made of the methods and costs in relation to the

frequency of visits by the recorder and the amount of assistance which the farmer actually receives. Unfortunately the international review referred to above does not deal with costs.

Even if allowance be made for the keeping of private records, it cannot be maintained that the progress of milk recording in England and Wales in recent years has been satisfactory. The scheme under which the county societies work was introduced in 1914 and it has undergone no material change during the twenty-one years that it has been in operation. A reconsideration of the whole scheme, in the light of results at home and methods and results abroad, and with a view to introducing such changes as would lead to greater popularity without any loss of reliability, is now necessary.

IV.—Secretion of Milk and Milking.

Structure of the Cow's Udder.

The act of milking, whether by hand or machine, is the first stage in the management of milk and is important because the method and the efficiency with which it is carried out affect the condition of the udder and also the quantity, quality and cleanliness of the milk. It follows that accurate knowledge of the structure of the udder is essential to an understanding of what happens before and during milking, and affords guidance as to the best methods of removing the milk.

A description of the structure of cow's udder appears in almost all textbooks on dairy herd management and milk production, but on many points there has been a lack of precise information. Recent work at the University of Missouri (Refs. 14 and 15) has added to our knowledge of the relationship of one quarter of the udder to another and of the average yield of milk from the respective quarters. It has often been noticed that, when the milk yield from one quarter is lessened by injury or disease, the total yield is not so much affected as might have been expected, and the opinion has been held that the milk secreted in one quarter can, in emergencies, be partially withdrawn from the other teats. A dissection of the udder and the injection of coloured dyes into the different quarters have shown that the right and left halves of the udder are separated by a ligament which also helps to carry the weight of the udder; the fore and rear quarters in each half are not separated in so definite a manner, but a thin layer of connective tissue divides these two quarters and does not allow the milk secreted in one quarter to filter into another; it follows that all the milk drawn from each quarter is produced in that quarter.

From the opening at the point of the teat a short duct or channel, surrounded by a circular muscle, leads to a cavity in

the middle of the teat. The circular muscle is designed to retain in the teat and udder the milk that gathers in the udder between milkings. It also prevents, to a large extent, the entrance of dirt. When this canal is very small a thin stream of milk is obtained and we then have one of the causes which make a cow a "hard milker." From the cavity in the teat a channel leads upwards to a much larger cavity or cistern in each quarter; this cistern is divided by thin layers of tissue into pockets of various sizes and its purpose is to store the milk, as it is made, until the next milking. From the cistern in each quarter large ducts or channels lead into the milk gland and, as they extend upwards, divide into smaller channels and each small duct ultimately ends in a small cavity (alveolus) in which milk secretion takes place. Surrounding each alveolus there is a network of blood-vessels, and the materials from which milk is made are taken from the blood by the cells lining the walls of each cavity.

The blood supply enters the udder by two large arteries—one entering the rear quarter of each half—and these send branches to all parts of the udder. After the milk-making materials, or some proportion of them, have been removed from it, the blood is collected in veins and returned to the heart. Some of this blood leaves the udder by the so-called "milk veins," visible on the under side of the belly, but veins also leave the udder by an upward route; hence the size of the "milk veins" can only be of limited value as an indicator of the supply of blood from which milk has been made. There is also a "loop" connection between the large veins on one side and those on the other, so that blood from every part of the udder can leave by the most suitable vein according as the cow is in a standing position or is lying on either side.

Even a superficial knowledge of the structure of the udder will make clear the delicate nature of the tissues and the need for gentleness in the general management of cows, care in attending to the udder at all stages and the adoption of methods of milking which will get the maximum quantity of milk from the cisterns through the teats without any undue stretching or injury. Instruction in milking should be accompanied by a brief description of the structure of the udder and the mode of milk formation.

In order to obtain information on the quantity and fat content of the milk secreted by the different quarters, a special milking machine was designed by the Missouri investigators in order to collect the milk from each quarter in a separate container, and results were obtained from seventy-four lactations of forty-five cows of different breeds. Each cow was milked one week in each four weeks by the special milking machine, and the other three weeks by an ordinary machine. It was found

that, on the average, the two front quarters produced 42 per cent. and the two rear quarters 58 per cent. of the total milk and that the right and left sides produced almost exactly 50 per cent. each. The average percentage yielded by each quarter was :— right fore, 21·38 ; left fore, 20·52 ; right hind, 28·55 ; and left hind 29·55 per cent. The rate of decrease in yield was on the average much the same for all quarters but there were numerous exceptions where one or more quarters decreased in yield and the other quarters increased proportionately. No attempt is made to give reasons for such changes. Regarding the fat content of the milk, no tendency was noticed for either the fore or hind quarters to yield milk richer in fat than the others. When however, owing to abnormal conditions, the yield of one or more quarters declined more rapidly than those of the others the fat percentage tended to increase in the former.

Milking Machines and Milk Yields.

The influence of machine milking on the yield of cows has been studied by Bartlett and Huthnance (Ref. 16). Three different machines had been used between 1925 and 1934 in the herd of the National Institute for Research in Dairying, and the milk records for that period were found to include eighty-four lactation yields of cows milked by machine throughout the complete lactation period. Each of these yields was "paired" with the yield of a hand-milked cow of approximately similar age and date of calving. Previous studies had shown no measurable differences between the results from the three machines, hence in this comparison all three machines were taken together.

The results obtained are stated below :—

	84 lact. periods hand-milked.	84 lact. periods machine-milked.
Mean lactation yield (lb.)	7,770	7,259
Service Period (days) (*i.e.*, interval between calving and effective service) . .	97	103
Days in milk	299	293
Days dry	83	95
Corrected lactation yield (lb.) (*i.e.*, corrected for age, month of calving and service period)	7,211	6,698

It is concluded, after statistical examination, that the differences are not conclusive, as the number of periods was not sufficient to measure accurately such small differences.

The persistency of yield throughout the lactation was also studied and it was found that at the fifth week after calving the average weekly yield of the two groups was practically identical but that, as the milking period progressed, the machine-milked group declined more rapidly, until by the thirtieth week

after calving the machine-milked cows were averaging 25·5 lb. less milk per week than those milked by hand. This difference was found to be statistically significant, hence it is concluded that the machines, or something associated with their use, caused the cows to be less persistent in milk production. The fat and solids-not-fat percentages were also studied, but there was no indication that the machine milking had affected the proportion of these constituents.

It is suggested that the apparent depression in milk yield may be overcome by improvements in machine milking and that decreases in yield often result from defective management. There is need for further investigation of this subject.

Effect of removing fore-milk on the fat percentage of milk.

It is well known that the first-drawn milk is very low in fat, and it has been suggested that a small proportion of the fore-milk could be discarded where it was necessary that the bulk milk should contain more than a given fat percentage. The effect of removing varying proportions of the fore-milk on the fat percentage of the remainder has been studied at the Cornell University Agricultural Experiment Station (Ref. 17) in relation to the requirement that Grade A milk in New York must contain not less than 3·5 per cent. of fat.

The amounts of fore-milk removed were five, ten, fifteen and twenty streams from each quarter of the udder. This method of measurement was adopted because it could be easily practised under ordinary milking conditions, although naturally the quantity of milk drawn by a given number of streams varied from cow to cow. It was found that the percentage of fat in the remainder of the milk was raised slightly as the quantity of fore-milk drawn was increased, but with cows naturally yielding milk of low fat content, the proportion which must be discarded —even though used for calf or pig-feeding—was too large to justify the practice economically. The largest proportion of the samples examined were drawn from Holstein cows since these constituted the major portion of the herd. With this breed the increase in the fat content of the bulk milk, due to the removal of the fore-milk, was as follows :—Five streams gave an increase of 0·06 per cent. fat ; ten streams 0·10 per cent. ; fifteen streams, 0·14 per cent. and twenty streams, 0·17 per cent. It is also noted that the twenty streams from each teat represented some 10 per cent. of the entire yield of milk produced at that milking. In breeds naturally yielding richer milk the increase obtained was slightly greater, but in such breeds the need for exceptional measures to raise the fat content of the bulk milk should only rarely occur. Incidentally, the results of this experiment show that the practice of discarding two or three

streams of fore-milk from each teat, (recommended with a view to lessening the bacterial count of the bulk milk) is certainly not a serious source of loss; in all the breeds studied, with the exception of the Jersey, the fat content in the five streams of fore-milk was under 2 per cent.

V.—The Composition of Milk.

Solids-not-fat content of milk.

Evidence continues to accumulate to the effect that the solids-not-fat content of genuine milk may fall below the so-called standard of 8·5 per cent. more frequently than was formerly supposed. Nicholson and Lesser of the University of Reading have published (Ref. 18) a comprehensive study of this subject based on a series of experiments carried out over a period of three years on a farm in Hampshire. They give also the results of tests of the milk from two other herds.

Samples taken from the Hampshire herd throughout the summer of 1930 confirmed the statements made by the purchaser of the milk that it was seriously deficient in solids-not-fat, and the owner gladly agreed to co-operate in a series of experiments with a view to bringing about an improvement. The farm is situated on the Upper Chalk formation and possesses permanent pasture of good type for this class of soil, reasonably good shelter and adequate water supply. The herd consisted of about fifty British Friesians comfortably housed, well managed and in good condition. Milking was done by machine, and was followed by efficient hand-stripping. The breeding records of the herd were studied but the low solids-not-fat content could not be traced to the progeny of any particular bull.

In the winter of 1930–31, thirty cows in the herd were divided into three groups of ten each, and the following system of feeding decided on:—Group I (Control) received a maintenance ration of 14 lb. "seeds" hay, 7 lb. oat straw, 30 lb. mangolds, with 3½ lb. concentrates per gallon of milk. Group II received the same ration except that 20 lb. of marrow-stem kale replaced the 30 lb. of mangolds. Group III received the control ration with the daily addition of 6 oz. per head of cod-liver oil and malt extract. The kale was given to check a local opinion that low solids-not-fat rarely occurred where green food formed part of the winter diet, and the cod-liver oil and malt extract were given to ensure a sufficiency of vitamins A, C and D in the ration.

The kale ration was given for about three months and the vitamin addition for about four months, and samples were taken at weekly intervals from October 28 to March 24. Throughout the winter the control group continued to give

milk low in solids-not-fat, the average being 8·18 per cent. The kale group showed no improvement, having an average of 8·13 per cent., while the cod-liver oil and malt group, though showing a very slight improvement in the morning milk, averaged 8·11 per cent.

The herd was turned out to pasture, day and night, at the conclusion of the above experiment and samples of the mixed milk were taken in May and the following months. The results showed a marked increase in the solids-not-fat content, the average for the cows which had been under experiment during the winter being 8·58 per cent. It should be noted that the advance in lactation would also contribute to this result.

In the following winter (1931–32) three groups of cows were again agreed on and the feeding was as follows :—Group I (Control) was fed as in 1930-31, except that oat straw was omitted. Group II received the same ration as Group I, with the addition of a mineral mixture—steamed bone flour, 2·0 parts; salt, 1·5 parts; wood charcoal, 1·5 parts; chalk, 1·0 parts; ferrous sulphate, 0·01 parts and potassium iodide, 0·005 parts—to the concentrates at the rate of 6 per cent. Group III received the same ration as Group I but was kept out-of-doors day and night throughout the winter, coming indoors at milking time only. The feeding of Group II was such as to ensure that there was no mineral deficiency and that of Group III was intended to reproduce as far as possible the grazing conditions which had been associated with an improvement the previous summer.

The experimental feeding was continued over a period of four months and samples from each cow were again taken and tested weekly. The control group attained a higher average (8·38 per cent.) than that of the previous winter, the mineral group showed a similar result—8·42 per cent., and the outdoor group averaged only 8·17 per cent. Thus no beneficial results could be attributed to the experimental treatment and the problem was still unsolved.

In the summer of 1932 the herd was turned out day and night as usual, and a slight increase in solids-not-fat occurred, though it was less marked than in the previous year. Also, three cows were kept indoors, day and night, on winter rations during May and these continued to produce milk low in solids-not-fat; but when these cows were turned out to grass in June one showed a definite rise, one a slight rise and one a decrease in the percentage.

Further experiments were carried out during the winter of 1932–33 when the groups and feeding were as follow :—Group I (Control), hay, 10 lb., oat straw, 7 lb. and mangolds, 40 lb., with 3½ lb. of a balanced concentrate mixture per gallon of milk.

Group II received the same maintenance ration and 10 lb. artificially dried grass per head daily in place of concentrates for three gallons of milk, and Group III received 2 lb. per head daily of dried whey as a supplement to the control ration.

The dried grass was included to provide, in the winter diet, a food resembling fresh summer grass, in view of the apparent slight effect of summer grass in raising the solids-not-fat content. Dried whey was given because, in addition to milk sugar, it contains, in rather similar proportions, the mineral substances found in milk.

The dried grass was given for a period of three months and no improvement resulted. After a lapse of two weeks 2 lb. beet molasses was given per head daily and this also was ineffective. The dried whey was given for four weeks without improvement, and after three weeks on the control ration, 2 lb. glucose per head daily was given for five weeks, also without effect. For a further three weeks 25 lb. of carrots per head daily was given in place of the mangolds, but again no improvement resulted. On the whole the percentage of solids-not-fat in the milk of all groups was somewhat better than during the previous winter.

During the early summer of 1933 four cows were again kept indoors on a winter ration during May and turned out to grass in June; in May the solids-not-fat percentage was low and in June no improvement was brought about by turning the cows out; in fact the improvement which had occurred in early summer in 1931 and 1932 was not repeated in 1933; this may have been associated with a later grazing season and less abundant grass than usual.

From the point of view of assisting farmers to increase the percentage of solids-not-fat in the milk of their cows, it is disappointing that these extensive experiments have proved negative and it can be inferred that the condition was not due to faulty nutrition. There were a few cows in the herd which consistently yielded milk well above the standard. No explanation is offered of the fact that a gradual improvement took place, throughout the three winters, in the control groups of cows and in the herd as a whole.

During the winter of 1931–32 and the following summer, samples were obtained from a herd in the Chalk Downs of Berkshire where Friesians, Ayrshires and Guernseys were kept. The results showed that the ten Friesians, sampled from November to February inclusive, averaged 8·23 per cent., and 82 per cent. of the individual samples were under the standard (8·5 per cent.); the nine Ayrshires averaged 8·62 per cent. and 39 per cent. of the individual samples were under 8·5 per cent., and the six Guernseys averaged 8·96 per cent. and two samples

out of seventy were under 8·5 per cent. During the following summer samples taken at intervals of two weeks showed a slight improvement from April to June.

Generally speaking, there is a definite probability that milk which is low in solids-not-fat during the winter will show some improvement—which may or may not be sufficient to bring the average over the 8·5 per cent. standard—during the following summer. On the other hand, it is well known that, on some farms, difficulty in maintaining the solids-not-fat content is more likely to occur during the summer than during the winter.

Further evidence on this latter point is supplied by the report of an investigation into the milk of a typical herd of Dairy Shorthorns maintained at the National Institute for Research in Dairying (Ref. 19). Composite samples of the milk of this herd have been tested weekly for five successive years and, in addition to other information gained on the chemical composition of milk, it is shown that up to July, 1933, the average solids-not-fat content had usually been about 8·90 per cent. During July, August and September of that year, however, the weekly percentage, especially that of the afternoon milk, frequently fell below the standard. This season was marked by warmth and drought so that green foliage crops, silage and additional concentrates had to be given to supplement the pasture from the end of June onwards. The results obtained certainly point to the shortage of pasture or other factors associated with drought conditions as the cause or causes of the decrease in the solids-not-fat content of the milk in this instance.

The Milk Regulations made under the Foods and Drugs Act presume, until the contrary is proved, that a sample of milk containing less than 8·5 per cent. solids-not-fat is not genuine, by reason of the abstraction therefrom of milk solids, other than fat, or the addition of water. The existence of this regulation makes it essential that producers should pay more attention to the solids-not-fat content of their milk and that the whole question should be thoroughly investigated in order to gain additional information on the circumstances under which the regulation is likely to be accidentally infringed, on the causes of deficiency and on the steps which may be taken to bring about an improvement.

Vitamin Content of Milk.

In recent years the vitamin content of foods, both for mankind and for live stock, has received close attention, and the articles and reports which have been published on the subject are wellnigh innumerable. The more important of those dealing

with vitamins in relation to the nutrition of live stock are summarized annually by Dr. Crowther in the "Feeding of Live Stock" section of this review. Because of the increasing attention that is being given to the nutritive value of milk, it seems desirable to refer briefly to the contents of some of the publications dealing with the vitamin content of milk.

The report of the Committee on Cattle Diseases (Ref. 4) referred to on a previous page contains a simply written account of the vitamins present in milk and of the effect of pasteurization on milk generally. A review of recent work on the nutritional value of milk and milk products has been published in the *Journal of Dairy Research* (Ref. 20). These publications should be studied by those who wish for detailed information.

Vitamin A, which is essential for growth, health and reproduction, is usually present in milk in relatively large amount, but there is evidence that the milk produced by cows on green pasture contains more of this vitamin than milk from rations containing no green food. It has also been demonstrated recently that the pigment carotene, present in green foods and responsible for the yellow colour of cream and butter, may be transformed in the animal body into the colourless vitamin A. It follows, therefore, that the vitamin-A content of milk is greatest when cows have plenty of green pasture, and that on indoor feeding, unless special precautions are taken, the content will be much reduced. In this country the concentration of vitamin A and carotene in milk and home-produced butter is at its lowest in early spring.

Attempts to maintain the vitamin A and carotene content of milk and butter at a summer level have been made, and good-quality lucerne hay and artificially dried grass have both been found efficient in this respect. In this country the maintenance of the colour of milk, cream and butter during the winter and early spring has a definite commercial importance, but there is as yet no indication that buyers will pay more for winter milk of a superior vitamin-A content. It has also been shown that the vitamin-A content of milk is largely associated with the fat, and that separated milk, from milk of both high and low fat content, contains only a very small quantity of the vitamin (Ref. 21).

The relationship found to exist between carotene and vitamin A raises the question of the content of the milk of the different dairy breeds in this respect. In spite of the deeper colour, *i.e.* higher carotene content, of Guernsey milk, it has been found that the butter made from the milk of Ayrshire and Shorthorn cows had quite as high a vitamin-A content, under similar conditions of feeding. A recent comparison (Ref. 22) of the milk of Friesian, Ayrshire, Jersey and Guernsey

cows, produced under the same conditions of feeding, has shown the difference in vitamin-A content to be insignificant.

Vitamin B, or the various vitamins now included in the "B complex," can be formed in the stomach of the cow by bacterial action, and the content of the milk remains more or less constant throughout the year, independent of season and changes in feeding. The supply in milk is apparently ample for all requirements.

Vitamin C, the absence of which causes the disease known as scurvy, is found in milk in limited amounts, and the concentration is apparently increased slightly when the cows receive ample supplies of green food. It is stated that "fresh untreated cow's milk, in the amounts normally consumed, contains a supply of this vitamin no more than barely adequate for the needs of the infant, and from cows not on pasture it may at times be inadequate" (Ref. 4). The vitamin-C content is also definitely decreased by heating or pasteurization, and the giving of the juice of oranges or lemons, or the juice of scraped swedes, to infants as a source of supply is now recommended whether they are consuming raw or pasteurized milk.

Vitamin D is particularly associated with the absorption of the mineral matter required for bone and teeth formation; its presence in adequate amounts is essential to good bone development and a deficiency causes rickets in both human beings and animals. A substance known as ergosterol is present in small amounts in living tissues (and can be made chemically) and exposure to sunlight produces in the body the active vitamin from this substance.

In milk, vitamin D, like vitamin A, is associated with the fat and its concentration varies from summer to winter. The amount is greatest when the cows are on pasture and is lowest in the winter months when fresh untreated milk is liable to be deficient. A deficiency in the diet can be remedied by the addition of cod-liver oil, and in addition, the vitamin-D content of the milk can be increased by a variety of methods.

"Vitamin D Milk."

In the United States, where apparently rickets is more prevalent than in this country, the production of so-called vitamin D milk has received much attention from research workers and also on a commercial basis. Three methods are apparently commercially practicable: (1) the addition of irradiated yeast to the ration of the cows, (2) irradiating the milk directly, and (3) adding to the milk a concentrated extract of vitamin D, usually made from cod-liver oil. All are practised in the United States, usually by systems of licensing producers and regulating production under definite standards of potency

(Refs. 23, 24 and 25). Other methods have also proved successful viz., adding cod-liver oil to the cow's ration (but this lowers the fat percentage in the milk), giving irradiated ergosterol to the cows in their food and irradiating the cows' udders and undersides with carbon arc lamps; these methods have not, however, as yet proved commercially practicable. Very few attempts have been made in this country to increase by irradiation or otherwise the vitamin-D content of milk (a method is known to be in use on two farms), and the product must be regarded as a special milk. Also there appears to be little or no demand for such milk from the medical profession. *The American Journal of Public Health* (Ref. 26) states that "the commercial interests have, as usual, taken hold of this idea and are pushing it" and quotes another report (Ref. 27) approvingly as follows. "Not until proper judgment and control of this entire matter is exercised by those having commercial, professional and patent interests can it be expected that general confidence can be secured and the public given proper products scientifically proved to be of real merit or worth. Only by such methods can exploitation of questionable products be prevented and legitimate products accepted."

VI.—Management of Milk and Milk Utensils.

Efficiency in the management of milk and milk utensils on the farm is usually judged by the bacterial content and keeping quality of the raw milk. The keeping quality, that is the length of time before the milk becomes sour or unusable, is noticed by the producer, the retailer who has no pasteurizing plant and the consumer; and, though a method of stating the keeping quality of milk is used in awarding points in clean-milk competitions (Ref. 28), it is too dependent on the sense of taste of the individual to be of value in legislation or in classifying milk for variations in price. The bacterial content is determined by standardized methods, and the maximum counts set out in the Milk (Special Designations) Order, 1923, for Certified and for Grade A (Tuberculin Tested) and Grade A milk have come to be used as representing excellent and good levels of efficiency.

The introduction by the Milk Marketing Board of the Scheme for the formation of an Accredited Producers' Roll, in which, so far as the bacterial condition of the milk is concerned, the Grade A level is required, has greatly increased the interest of the dairy farmer in those methods of milk production and management which will enable him to gain a licence and earn the bonus.

Reference has already been made to the available publications giving the necessary advice (see page 275) and it is now

only necessary to refer to some additional points which have been studied in recent research work.

Sterilization of Rubber Parts of Milking Machines.

In the Ministry of Agriculture's bulletin ("Modern Milk Production") the methods described for sterilizing the rubber parts of milking machines include (*a*) placing in the steam chest used for the utensils and sterilizing for fifteen minutes at 210° F.; (*b*) immersion in a chloride of lime, salt and washing-soda solution; and (*c*) immersion in water at 160° F. for twenty-five minutes. The first-mentioned of these methods is the easiest and surest, but the "life" of the rubber is shortened to some extent. The efficiency of immersion, after the usual thorough washing in water at different temperatures, has been studied at the University of California (Ref. 29) and the results are of interest. A special iron tank, 12 in. × 12 in. × 50 in., was made with an iron tray on supports inside (so that the parts to be treated could drain when necessary), a drainage outlet and a connection for a steam pipe. The rubber parts were immersed in water in the tank and heated as follows:—(*a*) to 170° F. for twenty minutes and allowed to remain in the heated water and cool gradually until the next milking; (*b*) to 170° F. for twenty minutes and the water then allowed to drain off; (*c*) to 185° F. then, without applying further heat, allowed to remain in the water for twenty minutes and the water then drained. Of these methods, the third gave much the best results as judged by the bacterial content of rinsings from the tubes, and there was little difference in the life of the rubbers. Chemical sterilization with (*d*) a chloride of lime solution and (*e* and *f*) two strengths of caustic soda solutions was also studied; none of these proved so effective as the heat treatment at 185° F., but the life of the rubber was appreciably longer. These solutions also required careful attention, especially in warm weather, to maintain the effective strength.

Milk Contamination by Churns.

The risk of contamination of milk through inefficient cleansing of milk churns has been studied by Provan (Ref. 30), who draws attention to the responsibility of the buyer for the thorough cleansing of the churns used for the transport of milk to his depôt. A total of 173 churns (eighty-seven in winter and eighty-six in summer) cleansed by twelve different buyers were examined at the farms, and their condition is stated in the following classification:—Good, 69; poor, 24; moist, 58; containing milk or dirty water, 17; and putrid smelling, 5. Provan also took rinsings of the churns to determine the contamination of the milk which would result from the condition

of the churns and found that during the winter months this would rarely exceed 2,000 bacteria per c.c., but that during the summer months the figure was exceeded in a large number of instances. He also points out that contamination is greater from moist churns than from those returned in a dry condition. It will be obvious that any initial contamination of the milk from the churns will act as a "starter" and contribute to the bacterial count of any sample taken from the churns on their arrival at the buyer's premises.

In this connection it is interesting to note that the third schedule of the contract forms issued by the Milk Marketing Board contains the following regulation :—"Railway churns to be thoroughly cleansed by the Purchaser and, if necessary, washed by the Vendor with boiling water and soda when received empty." This regulation places the responsibility jointly on the buyer and the seller. It is essential that churns be washed and, if possible, sterilized by the buyer; but a producer who intends to qualify for, and retain, his position on the Accredited Producers' Roll, will be well advised to sterilize all the churns at the farm, and thereby prevent any contamination of his milk from this source. The following extract from an American report (Ref. 31) deals with the same point:— "Most plants (depôts) are attempting to wash and sterilize cans promptly after dumping the milk. Even though the plants are doing a satisfactory job of cleaning the cans, these cans are not in the best condition for receiving milk twelve to thirty-six hours later unless the producer sterilizes the cans immediately before use. Experiments have shown that unless this is done the cans may add as many as a half-million bacteria per c.c. of milk."

Testing of Dairy Machinery and Apparatus.

Reference may be made here to the work of the Ministry of Agriculture's Machinery Testing Committee in so far as it relates to dairy machinery and apparatus. The Committee, with the co-operation of the National Institute for Research in Dairying, undertakes the testing of plant and apparatus at the request of the manufacturer or his agent. When the test is completed a report and certificate of performance are issued by the Ministry. The tests completed during recent years have dealt with the following appliances, and an informative extract from the report is also given :—

Frigidaire Direct Expansion Milk Cooler (Ref. 32). The makers state that the plant will cool forty-five gallons of milk per hour from cow heat to 40–45° F. when using water at 60–65° F. and a water supply pressure of not less than 25 lb. per square inch. The results obtained in the test justify the maker's claims

as regards cooling capacity, as stated in the specification, and also meet the accepted requirements as to the degree of cooling capacity to be expected from a milk cooling plant.

Gascoigne Milk Equalizer (Ref. 33). This device is used by fitting it to the tray of the milk cooler and rubber tubes are attached to convey the milk equally to a number of churns. By using the equalizer approximately equal quantities of milk from one cooler may be supplied to a number of churns simultaneously, provided that the device is accurately fixed and the cooler and equalizer are level. No difficulty was experienced in keeping the rubber tubes clean.

"*Lingard*" *Cotton Wool Milk Filter Discs* (Ref. 34). The rate of filtration was good. The efficiency of the discs in removing visible dirt was good when used with a protective wire gauze or perforated metal disc.

"*Dymond*" *Milk Cooler* (Ref. 35). This appliance is designed to cool milk in the churn. It is inserted into the churn, and water is run into a funnel communicating with a central vertical tube and thence to four radial vanes. The water courses upwards through these vanes and flows outwards through four slots to a domed top which rests on and overlaps the rim of the churn and distributes the cooling water over the outside of the churn. The cooler was found to be capable of cooling milk to a temperature within 3° to 5°F. of the temperature of the cooling water. Without agitation of the milk this result can be attained in one hour, the ratio of water flow to quantity of milk cooled being 6·7 to 1. With agitation the result can be attained in one hour with a water-to-milk ratio of 2·4 to 1. A single cooler of this type does not compare satisfactorily with the standard surface or capillary cooler in cooling efficiency or economy where, in general practice, more than one churn of milk has to be cooled within a limited period.

Gloucester O.K. Sterilizer (Ref. 36). This apparatus is designed for the sterilization of milk utensils on the farm. When the sterilizer was working inside a building and adequately protected from direct draughts and with proper attention to the fire, an effective sterilizing temperature (210°F.) was attained and maintained throughout the cabinet for at least ten minutes. When adequate protection from direct draughts was not provided, and wind and weather conditions were adverse, this temperature could not be maintained for the period indicated.

This testing scheme organized by the Ministry has developed slowly, and much time and care have had to be devoted in many tests to the devising of suitable methods of testing and of stating results. In their Third Annual Report (Ref. 37) the

Ministry point out that "the demand for standardized production must lead to the development in many directions of mechanical methods of securing standardization, and the Agricultural Machinery Testing Scheme, in enabling the manufacturers to obtain an unbiased opinion regarding the efficacy of a machine and the farmer guidance as to its value, would appear to give precisely the facilities which this situation would demand. Accordingly it may be expected that the scheme will obtain wide recognition in the future, as an important factor in the development of organized marketing."

Copies of the scheme and of the reports on tests which have been made can be obtained from the Secretary, Agricultural Machinery Testing Committee, 10, Whitehall Place, London, S.W.1.

VII.—Taints and Flavours in Milk.

The importance of flavour in milk tends to become obscured when milk from a number of farms is bulked together or when pasteurization is practised, but in direct sales of raw milk, particularly of the higher grades, and in the manufacture of cream, butter and cheese, a pleasing flavour, or at least the absence of definite taints, is essential. Our knowledge of the kinds and causes of flavours and taints is gradually increasing and from time to time specific instances are investigated and reported on.

Leitch reports (Ref. 38) the occurrence of a burnt or caramel taint which has caused occasional losses on farms in the West of Scotland. Milk possessing this taint is unsaleable, butter made from raw cream similarly affected is suitable only for cooking purposes, and, in the case of cheese, the taint may be noticed in the curd, may disappear during the ripening process and yet may impair the quality of the ripe cheese.

The bacteria which give rise to the taint were found by Leitch in one instance in a commercial starter, but in more recent cases he has found that the infection came from the udder of the cow. In herds where the taint was giving trouble, samples were drawn from the individual cows under conditions which excluded the possibility of external contamination, and on examination a varying proportion were found to possess the burnt flavour to a marked degree. In such cases, no hygienic measures, however perfect, could overcome the defect.

Regarding control measures, Leitch states that when infection comes from external sources, rigid cleanliness will be effective, but that when the infection comes from inside the udder, the only method is to find the infected cows and cease to use their milk for sale or manufacture. The milk of individual cows can be examined on the farm by taking

small samples, in the middle of milking, into sterile bottles, keeping these in a warm atmosphere for eighteen to twenty hours and examining them from time to time by smell and taste. Leitch also suggests that the milking of infected cows three times daily, with thorough stripping, will tend to keep the trouble under control and may lead to its disappearance. Pasteurization of the infected milk while still fresh will prevent the development of the taint, and efficient cooling of the newly drawn milk will delay its development.

American workers also report (Ref. 39) that lucerne hay, if given to cows one to three hours before milking, will impart a characteristic flavour to the milk—" a slightly sweet sensation when first taken into the mouth. Then a slight bitter or acrid taste appears and it persists for a few minutes even after the mouth is rinsed with warm water . . . The odour as well as the taste is pronounced." When the hay is given four hours or more before milking, the flavour is not detected.

James Mackintosh.

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THE FEEDING OF LIVE STOCK.

In the field of animal nutrition research the past year has been characterized by steady progress along lines previously laid down, and little in the way of essentially new conceptions or discoveries has been put forward. In view of their fundamental importance to the whole business of nutrition it is only natural that the intensive study of the individual ingredients of foods and their significance for the animal organism should continue to occupy a large share of the attention of investigators, and this work will form an appropriate starting point for our review.

I.—Nitrogen Supply Problems (Proteins, etc.)

Biological Value of Proteins.

The large part played by proteins in the make-up of animal substance and in the vital activities of the animal organism has always attracted the active interest of the nutrition research worker. The elucidation of the chemical character of the proteins in the closing years of the last, and the opening years of the present, century is one of the greatest triumphs in the history of chemical research. It opened a new volume in the encyclopaedia

of our knowledge of nutrition, the pages of which grow year by year but which will take long to complete.

Some thirty or forty years ago the view that all proteins were not of the same value in nutrition was no more than a hypothesis. To-day its truth can be both demonstrated in practice and explained in theory. We now know that the different values of the various proteins are due largely, if not entirely, to differences in the nature and amount of the different structural units (amino-acids, amides, etc.) through whose combination the protein has been manufactured, and into which it breaks up under the influence of the digestive agencies. (See *Farmer's Guide* for 1931, p. 80 ; 1932, p. 123, *Journal*, p. 283 ; 1933, p. 128, *Journal*, p. 296.)

To-day, therefore, in our efforts to attain "scientific" control of the supply of protein to our live-stock, we are obliged to take into account not only the *quantity* of digestible protein available in our rations but also its *quality* or *biological value.* The ideal protein supply would be one that provided, on digestion, the various *essential* amino-acids (*i.e.*, those which the animal itself cannot manufacture) in the exact proportions necessary to cover the animal's needs.

One may perhaps assume, for example, that the mixed proteins of cow's milk are ideal in this respect for the young calf, although not necessarily so for the young of other species. The more nearly a protein (or mixture of proteins) approaches in composition to this ideal the higher is its "biological value" and, other things being equal, the less of it will be required to meet the animal's needs.

The following figures from recent determinations of the relative biological values for growing chickens of the proteins of various foods (Ref. 1) may be taken as typical of the sort of results that are being obtained. The figures give the relative values, taking caseinogen as the standard.

Fresh Egg-white	130·6	Soya Bean	55·6
„ Egg-yolk	100·9	Peas (Split)	45·0
Caseinogen	100·0	Bean Meal	36·3
Fish Meal	85·3	Alfalfa	25·6
Meat Meal (fat-free)	74·1	Grass	22·0
Wheat Germ	68·0	Lentils	19·0
Dried Yeast	62·0		

The determination of the biological (or nutritive) values of proteins is simple in principle, but is beset with practical difficulties which have made many of the results of doubtful value. Those interested in the subject will find guidance in a recent review (Ref 2), in which are given a description of the methods used and a summary of results obtained to date. Although these results show considerable discrepancies, according to the

conditions under which they were obtained, they do permit of a few broad generalizations.

As a class, proteins of animal origin have usually proved to have higher biological values than those derived from plants. Of the animal proteins the highest values have been got for the mixed proteins of whole milk and whole eggs. The two common proteins of milk (caseinogen and lactalbumen) are neither of them separately as valuable as the total proteins of milk. This finds a partial explanation in the fact that caseinogen is relatively poor in the essential amino-acid cystine. Similarly, in contrast to the high value of the mixed proteins of the whole egg, the egg-white by itself and in the raw condition is toxic to rats, but loses its toxicity on heating to 80–100°C, or by admixture of pure caseinogen (Ref. 3) or egg-yolk. Of tissue proteins, those of liver and kidney apparently have higher values than those of muscle.

Cereal proteins, though inferior to animal proteins, have on the whole shown higher values than those of leguminous seeds. No safe guidance can yet be given, however, as to the relative values of the proteins of the individual grains within each group, or of the proteins from different parts of the same grain (bran, embryo, endosperm).

The relatively low value of the proteins of legumes is probably associated with a deficiency of cystine, and when this deficiency is made good, in a mixed ration, the results may be substantially improved.

It is probable that the mixed proteins of leaves, both in the green state and when quickly dried by artificial heat, have a high biological value. The loss of protein that occurs under haymaking conditions, however, seems to be accompanied by a lowering of biological value of the residue.

Whether the relative biological values of proteins are the same for the promotion of growth as for maintenance is uncertain but unlikely. Similarly we have as yet little information as to the ideal protein make-up for reproduction, lactation, or egg-production.

Whilst it is clearly of considerable scientific interest that we should be able to measure these various requirements separately, it will usually suffice for practical purposes to determine the gross effects of additions of different proteins (or protein-containing foodstuffs) to specified basal rations. Data of this nature have been obtained, for example, in experiments at the Hannah Dairy Research Institute on the value of different protein concentrates for milch cows. (*Guide* for 1933, Refs. 10, 11.)

In these experiments the results seemed to be closely correlated with the proportion of the amino-acid lysine in the make-up of

the different proteins, so that the following data from a later publication (Ref. 4) may be useful for guidance in the rationing of the dairy cow. The figures represent the proportion of the total nitrogen of the food that is present in the form of lysine.

Dried Skim Milk	8·34	Linseed Cake	4·21
Blood Meal	11·04	Linseed	3·34
Meat Meal	8·80	Oats	2·98
Beans	7·45	Wheat	2·47
Soya Beans	6·18	Maize	2·20
Peas	7·04	Flaked Maize	2·15
Dec. Earthnut Cake	4·46	Barley	2·19
Alfalfa	4·43	Red Clover Hay	2·62
Wheat Bran	4·40	Oat Straw	1·29
Cottonseed Meal	4·21	Beet Pulp	0·23

The same paper also contains figures for other amino-acids, including cystine and tryptophane, both of which may on occasion be limiting factors in connection with milk production. The figures for tryptophane indicate a marked poverty of this amino-acid in the proteins of meat meal.

In view of the extent to which manufactured products enter into the food of farm animals to-day, it is of interest to note that the biological value of a protein is apt to fall with exposure to high temperatures. This applies, for example, to bread crust or toasted bread as compared with bread crumb ; similarly the efficiency of the proteins of materials like fish meal, meat meal and dried grass may vary appreciably according to the temperature used in their manufacture and the period of exposure to heat.

Whether the value of protein is damaged (apart from a slight reduction of digestibility) by ordinary methods of cooking such as boiling or steaming is doubtful, although recent investigations (Ref. 5) suggest that deterioration in this respect may occur in the case of meat if the internal temperature exceeds 84°C.

Most of the work on the relative values of proteins has been carried out with rats, but such evidence as is available suggests that the relative values do not vary much as between such widely differing species as rats, rabbits, pigs and chickens.

It is doubtful, however, whether the same applies to the ruminants, for the bacteria and infusoria inhabiting the rumen have the power to use simple nitrogenous substances, such as amides or even ammonia, to build up bacterial proteins, which are ultimately digested and assimilated by the animal. Thus the proteins of food-stuffs or rations that contain also large amounts of " amides " may be expected to show a biological value apparently higher for cows and sheep than for non-ruminants. These facts also account for the observation made from time to time that part of the protein in the diet of the milch cow can be replaced by relatively simple non-protein nitrogenous

substances, such as urea or asparagine. Even ammonium salts have been used in this way with apparent success by German workers (Refs. 6, 7 ; also *Guide* for 1932, p. 126 ; *Journal*, p. 311), but their methods and results are not entirely convincing. A further complication that arises in the practical application of biological values of proteins is that, as a rule, the value tends to fall as the supply of protein to the animal is increased. This is clearly brought out in recent experiments at the Lister Institute (Ref. 8), a notable exception, however, being the proteins of whole milk, which showed a uniformly high biological value at all levels of feeding.

Protein Requirements.

Clearly the foregoing observations on protein quality have a bearing upon the practical problem of the quantitative protein requirements of the animal under different conditions, since obviously if proteins differ in value there can be no single "protein minimum" applicable to all proteins. In practice this difficulty is lessened by the fact that on the farm mixed rations, and therefore mixed proteins, are almost invariably used. Nevertheless differences in protein requirement may arise according to the nature of the ration.

Furthermore the protein requirement may be affected by the nature and amount of the other ingredients of the ration. Certain of the bodily needs can be met only by the supply of digestible protein, and in speaking of "protein requirements" we usually mean the minimum amount of digestible protein required to cover these specific needs alone. Should, however, the supply of oil and carbohydrates be inadequate to cover the remaining needs of the body, protein will be drawn upon to make up the deficit, and the apparent minimum protein requirement will be correspondingly increased. This is very well illustrated in the South African experiments referred to later (Ref. 10).

Protein utilization problems are usually studied by measuring, under the conditions for which information is wanted, the "nitrogen balance" of the animal, this being obtained by determining its intake and excretion of nitrogen. Any surplus of intake over excretion represents nitrogen retained by the body (presumably mainly as protein), whilst a surplus of excretion over intake represents a shortage in the supply of food protein, which the animal has been obliged to make good by sacrificing protein from its body reserves.

An experiment carried out at Leeds (Ref. 9) with two laying hens (Rhode Island Reds) is typical of this kind of work. Throughout the ten weeks of the experiment the birds were fed a ration consisting of 10 per cent. bran, 50 per cent. wheat meal, 30 per cent. maize meal, 9 per cent. fish meal, and 1 per cent.

cod liver oil, along with $2\frac{1}{2}$ per cent. of ground chalk and 1 per cent. of salt. All the food was weighed and analysed, as were also all the droppings and the eggs produced. The numbers of eggs laid were fifty-four and sixty-one, so that production was relatively heavy. That the protein consumed was adequate for the needs of the birds was shown by the fact that, at the end of the period, the one bird showed a balance of 8·77 gms. of nitrogen retained in the body and the other of 2·14 gms. This storage did not take place regularly throughout the ten weeks, the daily balances being irregularly positive and negative, but the positive balances on the whole period seem to justify the conclusion that the hen can obtain the nitrogen required for heavy egg production largely, if not entirely, from the food supplied during the laying period, and need not draw appreciably upon reserves of body protein built up during the preceding non-laying period. The further conclusion is drawn that, after deducting the estimated nitrogen requirements for maintenance, and in the case of the particular food mixture used, the average amount of digested food nitrogen required to provide for the deposition of 1 gm. of nitrogen in the egg was, in round figures, 2·5 gms.

Similar determinations of the retention of protein (or more strictly of nitrogen) by the growing pig have been reported from South Africa (Ref. 10). The conditions under which these experiments were carried out admittedly did not permit of great accuracy, but nevertheless the results are full of interest, especially as illustrating the difficulties arising in work of this kind from the individual idiosyncrasies of the animals used and the inter-relationship of protein utilization with the total energy supply of the ration and the rate of growth secured.

Where the total energy supply was adequate the maximum retention of protein with the rations used (pollard, barley or maize, skim milk, and blood meal) was 60–70 per cent. of the digested food protein, and it seems improbable that this could have been further improved by any increase in the amount of protein or energy supplied. The actual amount of protein retained tended to increase as the pigs grew, the amounts found in these experiments lying between $\pm$ 120–150 gms. per day for pigs of 40–50 kgs. (88–110 lb.) live-weight, rising to $\pm$ 160–200 gms. for pigs of 60–70 kgs. (132–154 lb.) live-weight, when the daily increase of live-weight of 550–650 gms. (1·2–1·4 lb.) was secured during a reasonably long period (three to four weeks).

The practical conclusions from the experiments as to the daily protein needs of the growing pig are summarized in the following table, which is based upon the assumptions that the daily increases in protein and live-weight taken may be regarded as quite satisfactory and that a 60–65 per cent. retention of protein is secured.

Weight of pig.	Protein retained.	Live-weight increase.	Digestible protein required.	
			60% retention.	65% retention.
kgs.	gms.	gms.	gms.	gms.
40–50	120	550	200	185
50–60	140	550	230	215
60–70	160	550	270	245
40–50	140	650	230	215
50–60	160	650	270	245
60–70	180	650	300	280

(1 kg. = 1,000 gms. = 2·2 lb.)

Computation of the amounts of starch equivalent per day, required by the pig at the different weights to secure the above live-weight increases, led to the conclusion that the 40 kgs. pig required 1·2 kgs. starch equivalent, rising to 1·5–1·6 kgs. at 50 kgs. live-weight, 1·8 kgs. at 60 kgs. live-weight, and 2·1 kgs. at 70 kgs. live-weight. These standards are approximately the same, for starch equivalent, as the Danish and Swedish standards, but for protein they are rather lower (see *Guide* for 1930, p. 125; see also later p. 321). In this connection it is of interest to note that the pigs used in the South African experiments were Tamworths and crosses of Large Black on Tamworth.

Further information on the retention of protein is also available from recent German experiments (Refs. 11, 12). In the first series a comparison was made of digestibility and nitrogen-retention by four different breeds of pigs. So far as digestibility was concerned little or no difference was observed either between the breeds or between different individuals within each breed, either at the same or at different ages.

On rations very rich in protein the percentage retention of nitrogen fell very rapidly, and was very small after a live-weight of 150 kgs. (330 lb.) was reached; on rations containing a normal proportion of protein the rate of fall of the nitrogen retention was much slower. The most important factor determining the amount of protein storage that can be effected is the individuality of the pig; each pig has its limit, beyond which it cannot be forced by increasing the intake of protein. Although the percentage retention of protein tended to fall with increasing age, the total amount retained tended to be higher for the heavier pigs than for the younger pigs.

In the later experiment (Ref. 12) the relative efficiencies of the proteins of dried yeast, extracted soya meal and decorticated groundnut cake were measured by means of nitrogen balance experiments carried out with pigs at five different stages of growth, viz., 50, 75, 100, 125 and 150 kg. The basal ration to which the above foods were added consisted of barley meal

ad lib., plus a fixed daily allowance of 100 gms. white fish meal until the pigs had reached 100 kg. live-weight. Up to a live-weight of 50 kg. (110 lb.) there was little difference in nitrogen retention between the three groups, but thereafter the soya meal group fell steadily behind the other two, which remained practically equal, as may be seen from the following summary :—

PERCENTAGE OF DIGESTED PROTEIN RETAINED.

Weight of Pig.	Yeast Group.	Soya Group.	Groundnut Group.	Average.
Kg.	%	%	%	%
50	48·0	48·5	44·0	46·8
75	37·5	34·7	44·9	39·0
100	31·6	29·5	36·5	32·5
125	33·9	23·9	28·8	28·9
150	27·5	24·8	27·9	26·7

The steady falling-off in the percentage retention with increasing weight is very clearly marked in all the groups. On the average of the five periods the amount of nitrogen retained per pig daily was 13·69 gms. for the yeast group, 11·71 gms. for the soya meal group, and 13·22 gms. for the groundnut group. The inferiority of the soya meal ration was further shown by the slower rate of growth of the pigs, especially after the live-weight of 100 kg. (220 lb.) had been reached. On this point, however, little stress can be laid, since each group comprised only three pigs and details of the individual live-weight increases are not given in the report.

It is not possible here to deal with a number of practical feeding experiments with dairy cows, pigs and poultry reported during the year, that have dealt with the effects of different levels of protein supply upon production, but the general tenor of the conclusions drawn from them is in support of the view that has steadily gained ground in recent years, viz., that the protein standards in common use are adequate and will probably admit of a little reduction if economic considerations make this desirable. The importance of protein supply for growth, milk production and egg production is so fundamental, however, that practical standards may well err a little on the side of safety.

II.—MINERAL SUPPLY PROBLEMS.

It is difficult to give a concise review of progress in the elucidation of mineral supply problems, for the reason that so large a number of mineral elements is involved. The proportion of these elements present in the animal body ranges from the relatively large amounts of calcium and phosphorus down to extremely minute amounts of certain other elements such as iodine and copper. The following data from the classic analyses

of Lawes and Gilbert, show how great may be the differences in the total amounts present in the body even in the case of the common elements, the figures representing grams in 100 kg. live-weight :—

	Potassium.	Sodium.	Calcium.	Phosphorus.	Chlorine.
Fat Ox -	146	93	1,282	678	55
Fat Calf -	171	109	1,176	670	62
Adult Pig -	163	82	772	465	57

The minerals, moreover, are distributed in very different and characteristic proportions in the different organs of the body, calcium and phosphorus predominating in the minerals of the bones, potassium in muscle and liver, sodium in the blood, and so on. In the case of milk, potassium, calcium and phosphorus, followed closely by chlorine, account for the greater part of the minerals.

A further factor of importance in connection with mineral supply is the ratio of bases to acids, since a sufficiency of bases must be present to ensure the excretion of the acids produced in the vital processes. If the supply of mineral bases in the organism is inadequate, then the deficit has to be made good by the breakdown of protein to provide ammonia and amine bases, thereby causing waste of protein. The weight of experimental evidence indicates, indeed, the desirability of having a moderate excess of bases over acids, although considerable variations may occur without apparent harm to the animal, since the blood is protected against wide variations.

The addition of mineral supplements to rations is now familiar practice, but perhaps insufficient attention is paid to the alternative method, available particularly in the case of cattle and sheep, and to a less extent with pigs and poultry, of effecting the enrichment of the diet in minerals through manuring of pastures and meadows. This applies particularly where a deficiency of potash is likely to arise. In a recent German experiment (Ref. 13) cattle fed on hay from grassland that had received potash manure gave better live-weight increases and bloom than others receiving similar hay from non-fertilized ground. In this case the former animals received in their ration about 950 gms. more potash (K_2O) per head than those of the latter group.

In further experiments with pigs it was found that an addition of potash to the food caused an enrichment of the muscles in potash, and it is suggested that this may have been in some measure responsible for the improved quality of the lean meat observed in this case.

These experiments also showed a definite "antagonism" between potash and lime. When an excess of lime was fed the potash content of the muscles and blood, and of most of the

organs, was reduced, whereas, although an excess of potash fed did not reduce the lime-content of the muscles and of the blood as a whole, it did cause a reduction of the lime-contents of the blood serum, liver, heart and kidneys. On testing this point further in experiments with rats, however, it was found that the calcium : potassium ratio could be varied very widely without any appreciable detriment to the health and growth of the animals, provided only that the amount of calcium supplied was sufficient to ward off the risk of rickets. Further work on the significance of potash supply is clearly desirable and may lead to some revision of our present views as to the incidence of potash deficiency in practice.

Data on the mineral requirements of different classes of live stock are still scanty and in part conflicting, and a few additions made during the year may be noted. Passing reference may be made to the concise review of the recent literature on the mineral metabolism of the dairy cow by Morris (Ref. 4) and the extensive review by Cruickshank (Ref. 14) of present knowledge relating to the significance of vitamins and minerals in poultry nutrition. The latter is full of interest for the student of nutrition.

The work of du Toit and his colleagues on the mineral deficiency problem in South Africa has been extended by a further series of experiments (Ref. 15) with lactating cows receiving a variety of mineral supplements in different proportions. The results indicate that under the conditions of the experiments there was very little possibility of a potash or chlorine deficiency when cows giving two gallons of milk each were run on pasture. It is provisionally suggested that the needs of such a cow will be met by 14 gms. of chlorine, 15 gms. of soda (Na_2O), and 38 gms. of potash (K_2O) daily. The ration used contained 6·8 gms. of lime (CaO), and this was apparently adequate, as was also quite a low supply of magnesium. In this connection, however, it must be remembered that the lactating animal is, to some extent, able to defend itself against mineral deficiency by a decrease in its milk production, apart from the normal fall due to advance of lactation; a factor of considerable difficulty is thus introduced into the study of the mineral requirements of the lactating animal.

As usual, studies of the problems of calcium and phosphorus supply and the inter-relationships of these elements figure most frequently in the literature, and a few recent contributions in this field may next be noted. Four reports deal with studies of the requirements of the growing pig.

In Danish experiments (Ref. 16) the effects of a variety of mineral supplements were studied, over a period of two and a half to three and a half months, with pigs initially six to eight weeks old. From the various observations made the conclusion

was drawn that the ratio of calcium to phosphorus in the food is more important than the absolute amounts of each that are given. A high ratio of phosphorus to calcium caused osteitis and tetany, whilst a low ratio caused osteoporosis and rickets. If the total intake of lime (CaO) fell below 0·2 per cent. of the dry matter of the ration, the pigs failed to maintain either normal growth or normal composition of the blood even when the phosphorus : calcium ratio was good. For 100 gms. growth, 1·4 gm. CaO and 2·6 gm. P_2O_5, were required. Addition of inorganic salts to a ration of cereals and skim milk, in order to make the P_2O_5 : CaO ratio about 1·6 and the calcium intake about 4·7 gms. per kg. dry matter, gave excellent results. Without vitamin additions and without direct light the pigs remained normal and healthy in all respects.

In work relating to the assimilation of calcium and phosphorus the supply of vitamin D is, however, an important factor. In the foregoing Danish experiments (in which the pigs were kept indoors) addition of vitamin D to a ration with a high phosphorus : calcium ratio caused better utilization of the calcium and improvement in the health and live-weight increase of the animal. On the other hand, when added to a ration with low phosphorus: calcium ratio it had the opposite effect. Light had a beneficial action, but could not altogether counteract the effect of a bad mineral balance in the food.

Later experiments (Ref. 17) have confirmed the above observations and have led to the practical conclusion that the daily ration of the young pig should contain 6–7 gms. phosphorus and 7–9 gms. calcium per kilogram of dry matter, which gives a calcium : phosphorus ratio of 1·25–1·30 : 1. If the feed consists of mixed cereals with skim milk the mineral supplement suggested is a mixture of 50 per cent. calcium diphosphate (precipitated bone flour), 30 per cent. ground limestone (or chalk) and 20 per cent. salt, 2½ lb. of this mixture being added to 100 lb. of the mixed cereals. Attention must also be paid to any possible deficiency of vitamins, to provide which an addition of lucerne in summer or roots in winter may be desirable.

The interesting observation recorded above of the influence of the phosphorus : calcium ratio on the action of vitamin D is also dealt with in a further Danish report (Ref. 18), in which the practical point is stressed that there is danger in the indiscriminate use of vitamin concentrates. Incidentally this report gives also the final conclusions of the Danish workers on the optimum mineral ratios for the growing pig, which are set out as follows :—

$$\frac{\text{Phosphorus Equivalents}}{\text{Calcium Equivalents}} = \frac{1\cdot0 - 1\cdot1}{1}$$

$$\frac{\text{Sodium Equivalents}}{\text{Potassium Equivalents}} = \frac{0\cdot6 - 0\cdot7}{1}$$

$$\frac{\text{Acid Equivalents}}{\text{Base Equivalents}} = \frac{0\cdot8 - 0\cdot9}{1}$$

The desirable proportions of lime (CaO) and phosphoric acid (P_2O_5) in the total ration per 100 parts of dry matter are given as 1·2 per cent. CaO and 1·5 per cent. P_2O_5. Thus a pig of 20 kg. (44 lb.) live-weight receiving 800 gms. (1¾ lb.) dry matter per day would be getting about 10 gms. CaO and 12 gms. P_2O_5, of which about 66 per cent. of the CaO and 50 per cent. of the P_2O_5 would be stored up in the body.

Six experiments are quoted to illustrate the differential effects of additions of vitamins A and D according to the varying mineral constitution of the rations. It is claimed that the amounts of vitamin concentrate used were not unreasonably high, so that the detrimental effects observed where the phosphorus : calcium ratio was low might easily arise in practice. The risk is greatest when the absolute amount of calcium in the ration is low. On the other hand a certain amount of phosphorus must be present in the ration in order to ensure favourable action of the vitamin, and the risk would appear to be less if the phosphorus content is high than if both calcium and phosphorus are low. Lastly, the experiments indicate that excessive supply of calcium is dangerous and that the trouble engendered by it is only made worse by additions of vitamin.

Since most of the foodstuffs commonly used for live stock are apt to be rather poor in calcium, Moellgaard advises that, as a rule, highly concentrated preparations of vitamins A and D should not be given to either man or beast except along with a calcium supplement.

In discussing the choice of this supplement he quotes experiments which show the pig to be very sensitive to alkalinity in its food minerals, adding that " all experiments indicate that the most certain method of inducing rickets in the pig is to give it large quantities of calcium carbonate in its food." For this reason, coupled with the reduced risk of injury which is ensured by having a good supply of phosphorus whenever vitamins are supplied, he is inclined to recommend a mixture of calcium mono and diphosphates as a suitable lime supplement for use when vitamin concentrates are to be given. Calcium carbonate should only be used when the food already contains a considerable excess of phosphorus. If the mineral supplies are in accordance with the standards given above there should be no necessity for vitamin D supplements.

Work on the same lines has been carried out by Dunlop at Cambridge (Ref. 19) with 156 pigs which were carried from weaning to bacon weights. Twenty-nine treatments, consisting of additions of different amounts of calcium, phosphorus and vitamin D, were studied, and the observations covered growth, appetite, food utilization, and the effects on the composition of blood and bone. Bearing in mind that the true requirement

of the animal for calcium and phosphorus must necessarily vary with the rate of growth and the economy of gain, the general conclusion is drawn that optimal results may be expected with a diet containing 0·45 per cent. of calcium in its dry matter when the average daily rate of growth, between the live-weights of 30 and 200 lb., varies from 1·0 to 1·4 lb. and the food utilization ratio from 3·0 to 4·0 lb. of dry matter per 1 lb. of live-weight increase.

For phosphorus a level of 0·6 per cent. in the dry matter of the food would appear to be generally adequate, but there is some evidence that the make-up of the cereal part of the ration may have to be taken into account, possibly owing to the varying amount of the phosphatic organic compound, phytin, present in different cereals.

The parallel problem of the bearing of calcium and phosphorus supplies upon the growth of chickens is under investigation at Aberdeen, and the work reported last year (*Guide* for 1933, p. 131; *Journal*, p. 299) has now been supplemented by further data (Ref. 20). The chicken problem is intensified by the fact that the bones of the chick are less completely developed when it emerges from the egg than are those of the mammal at birth. With the type of food commonly used for chick-rearing a deficiency of phosphorus is very unlikely but a deficiency of calcium almost certain to occur. The chick thus labours under a double disadvantage, and must effect a very active calcium metabolism if rickets is to be averted. Vitamin D has only a very slight influence in compensating for a lack of calcium in the food. Addition of calcium carbonate, by neutralizing the acid of the gastric juice, may defeat its object if, owing to this neutralization, the calcium is not absorbed and metabolized, and the condition of osteoporosis, already present, will then persist, and may indeed be exaggerated. It is doubtful whether the administration of calcium alone, without vitamin D, could avoid this complication.

Large amounts of calcium also interfere with the absorption and metabolism of phosphorus, and thereby produce rickets. Vitamin D prevents, on the one hand, the occurrence of osteoporosis, due to deficiency of available calcium, and on the other hand it prevents rickets, due to phosphorus deficiency.

Another mineral problem that has aroused considerable interest in recent years is that of the possibility of salt (sodium chloride) deficiency in many of the rations commonly used. Clear evidence of this has been obtained in experiments with pigs and chickens, and the Northern Ireland experiments with the latter seem further to indicate that the deficiency is one of sodium rather than of chlorine. Recent Dutch work (Ref. 21)

on the sodium requirement of the young chick may therefore be of interest.

In these "sodium balance" experiments it was found that the growth of chicks was considerably delayed when the ration contained only 0·013 per cent. of sodium, and that food consumption was very excessive in proportion to the rate of growth. From the results it is concluded that, for the first four to six weeks after hatching, it is desirable that the food should contain at least 0·4–0·5 per cent. sodium, but that from two months old a content of 0·3–0·35 per cent. will be adequate.

Judged by these standards a mixture of cereal meals, especially if much maize is included, will be deficient, since it will contain at most only about 0·05 per cent. sodium. Even if fish meal, containing 2 per cent. of salt, be incorporated in the ration, its sodium content will be raised only to 0·13 per cent. This might be brought a little higher by including other foods, but it would seem that the addition of at least ½ per cent. of common salt would generally be advisable, at any rate for the first few weeks.

In the Dutch experiments one group received an addition of 2 per cent. of salt to the basal (sodium-poor) ration, whereby the total sodium-content of the ration was raised to about 0·8 per cent. Within nineteen days eight chicks out of twelve had died. In experiments at Aberdeen (Ref. 21a) with adult fowls, a much higher degree of tolerance was found, no ill-effects being noted with as much as 3 per cent. of salt in the ration; 5 per cent., however, was definitely poisonous.

The pig would appear to be more tolerant than the hen to excess of salt, and in experiments at Aberdeen (Ref. 21a, 22) rations containing as much as 3·3 per cent. of salt were consumed without apparent detriment, whilst, when rations containing appreciably higher amounts of salts were offered, the pigs simply refused to eat.

The question of the need or otherwise for iodine supplements to rations still remains without a clear answer, but recent German experiments (Ref. 23) with iodine in organic combination open up a line of enquiry that has not yet received much attention. In these experiments iodized proteins and oils were fed to young pigs with apparently favourable effects provided the dosage was not too high. Thirty-six milligrams of iodine per head daily was apparently satisfactory, whilst 56 mgs. was detrimental.

III.—Vitamins.

The literature of vitamin research continues to reveal how widely the welfare of the animal organism may be influenced by the inter-relations of the supply of vitamins with that of other nutrients. The revelation of the beneficial effects to growth, health and disease-resistance that often accrue from the

supplementing of various diets with vitamin concentrates, or with foods rich in vitamins, has now developed a public interest that admits all too readily of commercial exploitation. Reference was made in the previous section to the need for informed guidance in the use of vitamin concentrates, and the warning may be reinforced from another source (Ref. 24). "The time has come when the public must be educated to realize that vitamin supplements do not constitute a nutritional short-cut to health. A vitamin concentrate can only correct a vitamin deficiency. It has no magic power of assuming the functions and properties of other essential factors of the diet. The metabolism of food in the body is a chemical process, and if this process is to proceed to the best advantage the correct constituents must be present in sufficient quantity and they must be present in approximately correct proportions."

Readers interested in poultry nutrition may again be reminded of Miss Cruickshanks' review (Ref. 14), in which past vitamin research with poultry is fully discussed. Out of the vast mass of vitamin-research literature of the year few investigations would appear to bear at all closely upon farm problems, and only a few of this class, dealing mainly with vitamin A, have been picked out for review.

Vitamin A.

This vitamin is very commonly described as a "growth-promoting" vitamin, but according to recent work at the Rowett Institute (Ref. 25) its action in this respect is not a specific promotion of growth but a warding off of growth-inhibiting disease that arises when the supply of it is deficient. In other words, "vitamin A is merely one of the many dietary components, known and unknown, that are essential for optimum development and growth in the organism. In this sense only is vitamin A a 'growth factor', and its claim to the title is no greater than that of any other indispensable dietary constituent. Its power of preventing disease remains beyond question." Whether this power is general, or is specific against definite diseases, cannot yet be said with certainty.

In experiments with rats at the Pennsylvania Institute of Animal Nutrition (Ref. 25) the effects of deficiencies of several of the vitamins upon growth, metabolism and body composition have been studied. In the case of moderate vitamin-A deficiency the most prominent effect in the early stages was a depression of the appetite, followed by reduced gain in live-weight and a reduced nitrogen storage, and with, eventually, the characteristic symptoms of acute avitaminosis.

In the vitamin-D experiments the rats on the vitamin-deficient diet used the food nitrogen more economically, showed

a higher proportion of protein in the body gain and a lower heat loss than those on the "complete" diet. On the other hand they were inferior in appetite, and in gain of fat and energy. There were no significant differences, as between the two groups, in the digestibility of either the protein or the energy of the diets, in the utilization of the energy of the diets, or in the gains in live-weight.

Deficiency of vitamin B_2 depressed the appetite, the growth rate, the production of protein and of fat, and the storage of energy, but did not affect the digestibility of either the protein or the energy of the diet. A water extract of a liver concentrate proved to be a satisfactory source of this vitamin.

Reference was made last year (*Guide*, p. 143; *Journal*, p. 311) to experiments at Cambridge on the possibilities of transmission of vitamin A from mother to offspring, which experiments showed that such transmission was very limited in extent. In those experiments (with rats) carotene had been fed as the source of vitamin A, and the highest liver reserve of vitamin A accumulated by any of the does under such conditions was 22,000 units (B.U.). In later work from the same laboratory (Ref. 27), with more concentrated supplies of the vitamin, this maximum has been raised as high as 300,000 B.U. When the doe's liver contained this large amount of vitamin, the vitamin A in the liver of the fœtus at birth was found to be about 30 B.U. per fœtus. On following the matter up to the time of weaning it was found that, while the store of vitamin A amassed by the suckled weaner was roughly related to the vitamin reserves of the mother, the amount stored by the young was very small compared with the doe's reserve. Thus, under the conditions examined, if the doe's reserve were 1,000 B.U. each young rat would be likely to store 10 B.U.; whilst if the doe's reserve were 50,000 B.U. each of her young would store about 40 B.U. of vitamin A. Wide variations may occur, however, so that considerable allowance must be made for individual idiosyncrasy.

The evidence reported last year (*Guide*, p. 143; *Journal*, p. 311) that vitamin-A deficiency may arise in pig-feeding under conditions that are normally regarded as good in practice, has since been confirmed by the work of Golding (Ref. 28) and the further experiments of Dunlop (Ref. 29).

The former reports two experiments in which twenty pigs received a control ration of barley, middlings, soya meal, meat meal, limestone and salt, whilst for twenty-eight others part of this ration was replaced by dried whole milk. Whereas the latter all made good progress up to bacon weights, three pigs of the former group died, whilst five others developed similar symptoms but to a less marked degree. The trouble yielded readily to administration of cod liver oil. The same trouble was

experienced in a third experiment, and in this case proved curable by the supply of cod liver oil or of a vitamin-A concentrate, but not by a vitamin-D concentrate. Examination of the livers of pigs from the different experimental lots confirmed the presumption that the trouble was probably due to deficiency of vitamin A.

In Dunlop's experiments ten different diets were used, of which seven produced the characteristic symptoms of vitamin-A deficiency, and two others appeared to be just on the border-line of deficiency. The rations on which the symptoms did not appear included yellow maize meal and alfalfa meal—two products upon which reliance for the vitamin-A adequacy of rations is commonly placed. Both these foodstuffs, however, have been found to produce undesirable effects in the animals at the levels at which they must be fed in order to prevent the onset of avitaminosis. Furthermore, each is liable to considerable variation in vitamin-A content, and Dunlop therefore recommends that the supply of vitamin A should be ensured by direct dosing of the young pigs at six weeks and eight weeks old with a vitamin concentrate of known potency.

In one group of three animals, on a diet high in maize, growth ceased in all cases, but was restored by small supplements of yeast, which suggests that the failure to grow may possibly have been due to a deficiency of vitamin B_2 in this diet.

The amount of vitamin A necessary to keep the body reserves at their original level was found to be approximately 60 mg. carotene per 100 lb. of food.

In passing, it is of interest to note that evidence of avitaminosis in pigs on "practical" rations was also obtained at Rothamsted in experiments designed for another purpose (Ref. 30).

Two American experiments (Ref. 31) that may be briefly reviewed dealt with the effects of diets deficient in vitamin A on the reproduction of sows. On a diet of barley supplemented by salt, calcium carbonate and casein, sows failed to breed, and showed all the outward symptoms of a deficiency of vitamin A; whereas other sows of similar breeding, age and weights bred normally on the same diet supplemented with cod liver oil or chopped alfalfa hay. All the pigs had free access to direct sunlight and were fed outside, so that vitamin-D deficiency was very improbable.

Lastly, in view of the tendency to rely upon dried alfalfa or similar greenstuff to furnish rations with an adequacy of vitamin A, a reminder may be given of the rapidity with which the vitamin-A content of such material falls after cutting, if exposed to ordinary haymaking conditions. In one American series of tests (Ref. 32) a cut of alfalfa left to cure in the field lost 80 per cent. of its original carotene-content in twenty-four hours.

Comparable samples dried artificially had from two to ten times the vitamin A value of the field-cured product. Differences also occur in different parts of the plant. According to American tests (Ref. 33), whatever system of curing is adopted, the vitamin-A content of young lucerne is much greater than that of the flowering plant. The vitamin A is located almost entirely in the leaves, the stems containing very little, a point which may be regarded as conferring a further advantage on quick-drying as against haymaking methods, because the latter inevitably involve considerable loss of leaves.

According to South African tests (Ref. 34), alfalfa is also outstandingly rich in vitamin C, a property which, however, would seem to have little practical importance for farm live stock.

IV.—Efficiency of Utilization of Food.

Under this heading may be noted a number of reports dealing with various of the factors that influence the efficiency of utilization of food such as digestibility, level of food supply, etc.

Firstly, in view of the intimate bearing of vitamin and mineral supply upon the utilization of maize, reference may be made to the careful comparisons of yellow and white maize that were included in the Pennsylvania experiments referred to in the preceding section (Ref. 26). In these experiments care was taken to ensure that the two rations compared were identical in composition and energy supply, the only difference being that the one ration contained yellow and the other white maize. Each ration was made adequate as regards minerals and vitamins B and D by means of appropriate supplements, but no addition of vitamin A was given. The results indicated that the yellow maize ration definitely excelled the white maize ration only in palatability and in gain produced in body-weight, whilst the white maize ration excelled in digestibility of food energy. In commenting upon the results, the authors point out that while white and yellow maize do differ in vitamin-A content, the extent of this difference is far from constant, and one cannot say that this is the only difference between the two types. "It must be understood, therefore, that even if it were an established fact (which it is not) that the vitamin-A content of maize varies directly as the quantity of yellow-coloured substance, there may still be other differences in nutritive value, possibly following other laws of distribution. The colour of maize, therefore, while ordinarily indicative of nutritive value, cannot be considered positively significant in this respect."

Cattle.

In the *Guide* for 1932 (p. 138; *Journal*, p. 306) data were given for the conversion of food energy into milk energy by the

dairy cow, as ascertained from work at the Pennsylvania Institute. The same subject has been investigated by Brody and his colleagues at the Missouri Agricultural Experiment Station, and their report (Ref. 35) deals also with maintenance energy requirements and the influence of the body weight of the cow upon the energetic efficiency of milk production. A few conclusions from the summary may be noted.

It was found that, when other variables were kept constant, 0·305 lb. of total digestible nutrients (T.D.N.) is required to produce 1 lb. of standard milk with 4 per cent. fat; and that 2·1 lb. of T.D.N. are required to produce a gain of 1 lb. live-weight. The digestible feed energy applied directly to milk production (that is, exclusive of energy required to cover maintenance and gain of weight) is about 1·6 times the energy of the milk; or, expressed in another way, the *net* energetic efficiency of milk production (ratio of milk energy to digestible feed energy less maintenance energy) is about 60 per cent. This is the efficiency of the mammary gland, and is the theoretical maximum efficiency of conversion of food energy into milk energy.

The *gross* digestible feed energy required for milk production (*i.e.*, including maintenance energy) is about three times the milk energy; or, in other words, the gross (or overall) energetic efficiency of milk production (*i.e.*, ratio of milk energy to *total* digestible energy) is about 30 per cent. (15–25 per cent. in poor producers; 25–35 per cent. in average producers; 35–45 per cent. in superior producers). The digestible-energy cost of maintenance is about 2·4 times the basal metabolism.

In making the computations on which these conclusions were based it was assumed that 1 lb. T.D.N. supplies 1,814 Calories (or 4 Cal. per gram), and that 1 lb. of "standard" (4 per cent. fat) milk contains 340 Calories. It was also assumed, on the basis of earlier Missouri work, that the energy requirements of cattle for maintenance increase with the 0·73 power of the body-weight (*i.e.*, increasing body-weight by 100 per cent. increases maintenance requirement by about 70 per cent.)

In the groups of cattle from which the data were obtained, it was found that the *gross* efficiency of milk production tended to fall with increasing live-weight, but the view is expressed that, if strictly comparable conditions could have been established for the various-sized cows, the gross energetic efficiency of milk production would probably have been found to be independent of live-weight. Since larger cows tend to produce more milk than smaller cows there is a tendency to be more liberal in feeding them, whereby a reduction of efficiency in the utilization of food energy is apt to take place. "We believe that if hereditary capacity for milk production, nutritive level including body

fatness, and activity were the same, the energetic efficiency of milk production would probably be the same regardless of body size. Under customary conditions, however, gross energetic efficiency tends to decline with increasing live-weight."

In feeding experiments with milch cows the gains or losses of live-weight introduce a complicating factor in assessing the results. A tentative method of correcting milk yields for such live-weight changes was described by Rupel of Wisconsin at the 1934 Summer Meeting of the American Dairy Science Association and may be explained as follows:—First, according to Forbes, the utilization of nutrients for body gain is 77 per cent. as efficient as for milk production. Hence the quantity of food producing 336 Cal. of milk (= 1 lb. "standard" (4 per cent. milk)) can produce 260 Cal. body gain. Second, according to Haecker, 1 lb. of body increase in a mature cow is equivalent to 2,700 Cal. Hence, 1 lb. body gain during lactation is equivalent to $\frac{2,700}{260}$, or 10·4 lb. of "standard" milk; whilst 1 lb. body loss is equivalent to $\frac{2,700}{336}$, or 8·03 lb. of "standard" milk. Thus on this method when a cow gains in weight her milk yield is corrected to constant weight by increasing the yield by 10·4 lb. milk for each pound of gain in body-weight; when weight is lost, the actual milk yield is reduced by 8·03 lb. for each pound of live-weight lost.

If, similarly, it is desired to correct the food consumption to standard weight the data put forward by other American workers (Ref. 36) may be used, viz., that 3·53 lb. of total digestible nutrients is required for 1 lb. live-weight gain and that 2·73 lb. T.D.N. is equivalent to 1 lb. loss in live-weight.

Pigs.

Valuable data on the energy requirements of young pigs for maintenance, growth and fattening, as well as on the energy gains of the body, are now available from comprehensive experiments carried out at the Copenhagen Agricultural Experiment Station (Ref. 37). The rations used consisted mainly of barley, maize, wheat, and skim milk, with additions in some cases of pea meal, dried blood, dried yeast, soya meal, and a vitamin concentrate. Rations of varying amounts, with high and low protein contents, were used, but little difference was found in the proportion of metabolizable (utilizable) energy, whether expressed as Calories per kilogram of dry matter or as a percentage of the gross energy, the latter ranging from 80·0 to 80·9 per cent. It was practically independent of the amounts of protein, total feed, individuality and intensity of production.

The amount of metabolizable energy was found to be 10–15 per cent. higher with pigs than with cattle, owing to lower fermentative loss during digestion, this ranging from 0·50 to 1·32 gms. (average 0·95) of methane per 100 gms. digestible carbohydrates with the younger pigs (50–100 kg.) and 1·11 to 1·94 gms. with the older pigs (170–210 kg.). In experiments with older, almost mature pigs, whose live-weight increase was thus due almost entirely to fattening, the net energy of the rations was only slightly lower with a high than with low protein content. On the average of four experiments (two high and two low protein) it was found that with pigs at this stage the quantity of feed that would produce 770 Cals. of live-weight increase in cattle would produce 1,000 Cals. in pigs. In other words, the net energy for fattening of pigs is 30 per cent. higher than for cattle. This figure agrees reasonably well with the results obtained by Fingerling (see *Guide* for 1931, p. 100).

The net energy for maintenance amounted to 81 per cent. of the metabolizable energy, or 12–13 per cent. higher for maintenance than for fattening, which, combined with the above figure for the relative fattening values, implies that the feed possesses 45 per cent. more value for the maintenance of swine than for the fattening of adult cattle.

It is customary to assume that the maintenance requirements of animals of different sizes varies as the two-thirds power of their live-weights, but in these experiments with pigs the five-ninths power was found to be more suitable.

As to the energy requirements of young pigs for growth combined with fattening, it was found that the value of the feed for production of growth and fattening in the young pig was 25 per cent. higher than for fattening mature cattle.

With a ration high in protein (and a relatively large body gain of protein) the energy requirement was somewhat greater than with a low-protein ration (and a relatively small gain of protein). On both kinds of ration the net-energy requirement for production was rather lower for the adult than for the young pigs, or, in other words, the energy requirement per 1,000 Cal. gained showed a tendency toward being greater for growth than for fattening, but the difference was too small to warrant any discrimination.

The gain in energy in the case of the young, growing pig amounted to 65–70 per cent. of the metabolizable energy in the production feed, *i.e.*, that supplied in excess of the maintenance requirement. The proportion was rather less, 65·3 per cent. compared with 69·1 per cent., on the high-protein than on the low-protein feed.

The energy content of the live-weight increase, as was to be expected, showed great variations, being influenced by age,

quantity of protein and feed, and the rate of live-weight gain. The notable influence of protein supply is shown by the following average figures :—

	Number of experiments.		Cal. per 1 kg. live-weight gain.
Low Protein . . .	26	...	4,960
High " . . .	16	...	3,470

The moral as to the unreliability of live-weight gains as a measure of feeding effects is obvious.

As to the gain of energy in the pigs during growth, the amount of energy stored up as protein per 100 kgs. live-weight decreased from about 2,600 Cal. at 20 kgs. live-weight to 700–800 Cal. at 90–100 kgs. live-weight. The total gain of energy in the form of protein plus fat per 100 kgs. live-weight was relatively constant at all live-weights, ranging between 4,000 and 5,000 Cals. The conclusion is drawn therefore that pigs fed for bacon will gain 45 Cal. per 1 kg. live-weight in protein plus fat anywhere between the live-weights of 20 and 100 kgs., whilst the gain of energy in the form of protein will decrease in a curve from 26 Cal. per kg. live-weight at 20 kgs. to 7 Cal. per kg. live-weight at 100 kgs.

On the basis of the experimental data the following table of feeding standards is given for practical use. It is assumed that a moderate rate of fattening is aimed at and that the pigs have comparatively little freedom of movement :—

Live weight.	Net energy per feed unit.	Feed units per day.	Starch equivalent.	Digestible protein.
kg.	cal.		kg.	gms.
20	1,520	0·86	0·55	159
30	1,535	1·19	0·77	202
40	1,560	1·48	0·98	227
50	1,580	1·77	1·18	240
60	1,595	2·04	1·38	245
70	1,610	2·30	1·57	245
80	1,625	2·56	1·76	246
90	1,640	2·81	1·95	238
100	1,650	3·06	2·18	235

The starch equivalent data are not given in the original. It will be noted that the prescribed concentration of the ration in net energy (or production energy) rises gradually with rising live-weight. These net energy figures are based upon the ordinary (Kellner) net energy values for the fattening of cattle (1 kg. Starch Eq. = 2,365 Cals.). As indicated above the actual net energy derived by the pig from the weights of food will be substantially higher than these figures.

For a critical analysis of existing information on the net energy requirements of the bacon pig, interested readers may

be referred to a recent Swedish report (Ref. 37a) that must now rank as the standard work on the subject.

The scientific basis of pig rationing arrived at from the foregoing experiments does not necessarily represent the ideal conditions for practice, since it takes little or no account of economic considerations, nor of the effect of the feed upon the quality of the carcase, except in so far as this may be affected by the storage of protein (lean meat) in the body. Some recent American experiments (Ref. 38) usefully supplement the Danish work in these respects.

In the American experiments the effect of varying quantities and kinds of feed on the economy of live-weight gains and on the body composition of pigs was studied in practical feeding experiments, supplemented by determinations of the proportions of lean to fat in the body as a whole and in the various parts thereof.

It was found, on restricting the allowance of individually-fed growing pigs to approximately three-quarters and one-half of a full feed, that although the rate of live-weight gain was slowed down, the quantity of feed required to produce 1 lb. of gain was generally also decreased (*i.e.*, the economy of utilization of the unit of feed was increased). Pigs fed on a ration of maize, with protein supplements, at levels of 4, 3 and 2 lb. feed per 100 lb. live-weight, gained from an initial weight of approximately 65 lb. to a final weight of 200 lb. at average rates of 1·14, 1·03 and 0·77 lb. per day respectively. The feed consumption per unit gain showed, however, a significant decrease with the decrease in feed level, the group on the highest feed level requiring 34 per cent. more food per unit gain than the group on the lowest feed level. Similar results were obtained with rations in which the maize was replaced by wheat, but in this case the difference in feed consumption per unit gain between the high-level and the low-level groups was less than in the case of the maize ration.

The observations made in these experiments on the influence of the various levels of food supply upon the quality of the carcase will be discussed in the next section.

Digestibility.

In view of the fundamental importance of digestibility to the utilization of food, a few recent contributions on this subject may be noted.

In German digestibility measurements with sheep (Ref. 39) the effect of varying "nutritive ratio" was studied. In mixtures of concentrated foods with varying proportions of clover hay, clover silage, potato silage and maize silage the digestibility of the crude protein was apparently unaffected, but when increasing quantities of straw were brought into the ration the digestibility of the protein gradually fell.

The digestibility of fibre in coarse fodders was good and approximately the same for all, but in foods poor in fibre (concentrates, potatoes, etc.) it was uniformly low. Combination of concentrated foods with the coarse fodders, especially in the case of hay, caused a reduction of fibre digestion, despite the narrowing of the nutritive ratio. Addition of straw to the various combinations reduced the digestibility of the fibre below those obtained with straw when fed alone.

The digestibility of the nitrogen-free extractives ("carbohydrates") was to a great extent inversely proportional to the fibre content of the individual foods or rations. Addition of concentrated food to clover hay, clover silage, or maize silage had no effect on the digestibility of the nitrogen-free extractives; addition of straw also had no effect on this item, although it tended to depress the digestibility of all the other nutrients. The general conclusion is drawn from these experiments that only a limited importance need be attached to the nutritive ratio as regards any probable influence on digestibility.

In Canadian experiments with cattle (Ref. 40), hay was fed at levels of 2·5, 4·5, 6·0, 7·5, and 9·0 kgs. per head daily without any significant effect on digestibility being found, except for an apparent slight reduction at the lowest level, possibly owing to the fact that at this semi-starvation level the food was bolted, so that rumination and digestion were neither normal nor complete.

Frequent reference has been made in our previous reviews to the experimental work on horse feeding carried out at the University of Breslau, one of the few centres at which horse-feeding problems have received much attention. A further report (Ref. 41) compares the performance of horses on green food (lucerne-clover mixture) with that on a conventional ration containing concentrates. Good results were obtained for light and moderate work, but for heavier work a mid-day supplement of concentrate rich in carbohydrates is recommended. The green food was fed satisfactorily in daily quantities up to 80–90 kgs. per 1,000 kgs. live-weight. In determining the starch equivalent of the green food it was found that a "value" correction of sixty-five was necessary as against Kellner's seventy-five for cattle. Similarly, if the correction of the "theoretical" starch equivalent be based upon the total fibre, the standard deduction arrived at by Kellner for cattle must be raised 30–40 per cent. for greenstuff fed to horses; or, in short, the starch equivalent for horses is 8–12 per cent. lower than for cattle. The Breslau work indicates that Kellner's standards for energy requirements of horses at light or medium work can be reduced by 18–20 per cent., and Hansson's standard by 15–17 per cent.

In this section also reference may be made to Fingerling's

precise determination of the starch equivalent of mangolds ("Runkelrueben") for cattle and pig feeding (Ref. 42). It was found that whilst the general digestibility (as measured by total organic matter) of the mangolds was the same for both the cattle and pigs, the latter showed a rather higher digestibility for the crude protein and slightly lower for the nitrogen-free extractives. The "availability" of the digested energy was, however, much lower with the pigs than with the cattle. The average results of the metabolism experiments gave a starch equivalent for the dry matter of mangolds of 51·2 per cent. for cattle and 37·9 per cent. for pigs. On this showing it would not seem wise to go far in the introduction of mangolds into pig fattening rations.

Lastly, in this section mention may be made of further American experiments (Ref. 43) on the influence of grinding on the digestibility of maize by pigs (135–196 lb. live-weight).

Grinding to a medium degree of fineness (29 per cent. passing a forty-mesh sieve, 58 per cent. a twenty-mesh sieve, and 95 per cent. a sieve with twelve meshes to the linear inch) increased the digestibility of the protein by 13 per cent., but the general digestibility (digestibility of gross energy) of the maize was raised only 2·8 per cent. The metabolizable (utilizable) energy was also only slightly improved, viz., by 3·5 per cent. Furthermore, the appreciable advantage in protein digestibility obtained by grinding was largely lost through greater waste of nitrogen in metabolism, so that the net effect on the nitrogen balance of an animal receiving an exclusive ration of maize was slight and variable. The net effect of grinding upon the nutritive value of maize for pigs of the weights used in this test was thus to increase its value as a source of energy by 3·5 per cent., whilst its value as a source of protein was not appreciably altered.

This is in accordance with the conclusions arrived at in a recent Canadian review (Ref. 44) of the evidence from practical feeding experiments, but is in sharp contrast to the results of Swedish experiments previously quoted in these Reports (see *Guide* for 1930, p. 132). It must be borne in mind, however, that the data obtained in practical feeding experiments are the resultants of a number of factors apart from any alteration of digestibility, such as palatability and wastage at the feed trough. The latter will generally be greater with meal than with whole corn, since any of the latter lost from the trough will be more easily salvaged by the pig.

A further interesting observation from the report on the above-mentioned American experiments is that one pig which appeared to be passing, unbroken and undigested, more than a third of all whole maize kernels consumed was found to have digested the whole maize fairly well, except for the fibre. While

grinding improved the digestibility of the maize for this pig somewhat more than for the others, the relative improvement was far less than would have been expected from the physical examination of the droppings for unbroken kernels, proving the latter method to be quite unreliable as a criterion of completeness of digestion. For this pig the increase of utilizable energy effected by grinding was 11 per cent. as compared with an average of 2 per cent. for the other four pigs.

V.—Influence of Food on Carcase Quality.

The investigation of the factors that determine carcase quality is beset with very great difficulties owing to the impossibility of defining "quality" in precise terms. Apart from the quantities of fat and lean and their distribution in the different parts of the carcase, none of the various criteria that together constitute quality, such as colour, aroma, texture of lean and fat, cooking quality, is capable of exact measurement, and these can only be assessed by methods which, though perhaps adequate to differentiate good quality from bad quality, are unreliable for the more common case where intermediate grades of quality require to be classified.

For a brief general review of the subject the reader may be referred to the *Guide* for 1932, p. 111; *Journal*, p. 271 (also 1933, p. 137; *Journal*, p. 305). A few recent reports dealing with the problem as it affects the pig call for special mention here.

Firstly, we may now complete our references to the American experiments (Ref. 38) with different quantities and kinds of feed, from which the growth results were given in the last section (p. 322).

The analysis of the carcases showed that the pigs on the lowest feeding level of maize and of wheat contained a significantly greater proportion of lean meat, and yielded a higher percentage of lean cuts, than those more liberally fed, but the total amount of fat in the body as a whole was less. No marked effect on the fatness of the body resulted from restriction of the rations to 50 per cent. of a full feed when pigs were killed after putting on only some 50–60 lb. live-weight.

Although the restricted feeding apparently resulted in a slight decrease in the firmness of the carcases in the maize-fed lots, no significant differences were found in the palatability factors of the cooked meat as between high and low feeding levels of either maize or wheat.

In our own country systematic investigation of problems of meat quality is in progress at the Cambridge Low-Temperature Research Station, from which has been issued a valuable review of the available information on the relation of growth and diet to carcase quality in the pig (Ref. 45). A few points of interest

from the dietary section of the article may be summarized here, although they do not necessarily represent additions to knowledge during the year under review.

The view is expressed that efforts to ensure good growth and carcase quality by feeding should commence with the pregnant sow, whose diet should be adequate with regard to supplies of proteins, mineral elements and accessory food factors (vitamins, etc.).

After birth the most critical period is that round about weaning. According to Hammond, retarded growth at this period has an adverse effect upon the amount of muscular tissue developed in the pig, and especially as regards the particular muscle that constitutes the "eye" of meat in the loin. Results in accord with this view were obtained experimentally some years ago by American workers, who found that the size of the "eye" was not affected by the diet after weaning.

Deficiency of protein in the diet slows down growth and usually results in a carcase with a high proportion of fat to lean. If the pig is very restless, however, a very thin carcase may be produced. The over-fatness of the pig on the protein-deficient diet is in part due to excessive consumption of carbohydrates and in part to alterations in the conformation of the pig occasioned by the lack of protein, *e.g.*, from a long type to a short type. Similar changes may arise from mineral deficiencies of the diet.

Just as an incomplete diet has a retarding effect on growth, so a high-grade diet has a stimulating effect. Every pig has a characteristic individual capacity for flesh (lean) formation and this can only be developed to the full when the rations contain sufficient proteins, minerals, etc., to permit of optimum growth. Optimum growth, however, is not necessarily synonymous with optimum quality or optimum economy.

Curiously enough, in view of the widespread belief to the contrary, there is as yet no evidence that exercise can increase the quantity of muscular tissue.

The tendency of the oils and fats in the diet to impress their chemical characteristics on the body-fat is now familiar knowledge. If the diet is practically free from fat the body fat will be made chiefly from carbohydrate and to some extent from proteins. Fat made in this way is usually of a firm, hard type. The presence of a softening oil in the diet has a softening influence on the body-fat, the intensity of which rises as the proportion of the oil in the diet increases. This effect is more marked in young than in older pigs, and also in slow-growing pigs than in rapidly growing animals.

Although diet has a marked effect on the nature of the fat of the body it has relatively little influence upon the chemical composition of bone and muscle. An exception to this general-

ization is the effect of a deficiency of calcium and phosphorus in impairing the growth and composition of bone. An adequate growth of bone is highly important since not only does it increase the size of individual bones, but there is some evidence that the degree of development of an individual bone affects the size of the attached muscles.

Although muscular tissue is the most valuable part of the carcase there is little evidence available as to the effect of diet on its composition. With increasing age muscles contain less water and more fat. The concentration of mineral ingredients in the muscular tissues can be affected to some extent by the diet, but the chemical nature of the muscle proteins is apparently not affected.

The views of consumers as to quality in foodstuffs may vary considerably, but on one point, at any rate, both with pork and bacon, there is a steadily increasing consensus of opinion, namely, in the preference for cuts with a large proportion of lean meat which is almost completely separated from the fat. Moreover the fat should be firm, and sufficient fat should have been laid down *in* the muscles to ensure that the lean meat will not dry out on cooking. The lean meat, moreover, must have a full flavour and be not unduly pale in colour. The latter defect may be due to anæmia or to lack of exercise.

The colour of the fat is also of importance. This is normally white in the fresh carcase, but tends to assume a yellow tinge through oxidation, especially if the fat is soft and left exposed to light. These changes are associated with the development of rancidity and may set in quite suddenly or more slowly. Cod liver oil in the diet apparently speeds up the process—a point that offsets its value as a source of vitamins A and D. It is obvious that in any tests of the effect of foods on the quality of bacon-fat the observations must extend over the whole period of storage of the bacon.

With the establishment of the Bacon Pigs Marketing Scheme the question of the assessment of carcase quality has become a live practical issue, and much scepticism prevails as to the validity of the current method of assessment based upon thickness of shoulder fat and of streak. That the thickness of back-fat at one point only is not a reliable guide to the fatness of the carcase as a whole may be stated almost with certainty, but recent American measurements (Ref. 46) made on sixty carcases indicate for representative animals a high degree of correlation between the total fat in the edible portion of the carcase and the average thickness of fat measured at five specified points along the back, the average results being expressed by the equation: Fat per cent. in Edible Carcase $= 22{\cdot}45 \pm 0{\cdot}691 \times$ average thickness of back-fat (in m.m.).

On the other hand, Callow and Davidson (Ref 47) found little or no correlation between the thickness of the back-fat and the amount of fat in a single muscle.

A quick, reliable method of estimating the degree of fatness of lean meat that could be carried out on an intact carcase would be of great practical value, and in the review from which we have quoted above Callow makes the interesting suggestion that a solution may be found on the lines of measurement of the electrical resistance of the muscular tissue, since this rises and falls with the amount of fat present.

A brief reference was made above to the importance of the colour of the lean meat as a criterion of quality. Information on the factors that control this colour is extremely scanty, so that further data provided by recent Danish investigations (Ref. 48) are very welcome.

The meat products involved in this case were beef and veal, the investigation comprising observations on thirty-two dairy cows, twelve young bulls, twenty-five young steers and nineteen whole-milk-fed calves, three breeds being represented.

The variety of rations tested cannot be conveniently summarized, but in no case did the feed seem to exert much influence on the colour of the meat of animals of the same age and sex. An iron-rich ration of natural feeds seemed inclined to give a rather darker-coloured meat than an iron-poor ration, this being accompanied by a lower hæmoglobin content of the blood in the latter case.

Green grass, clover and alfalfa tended to produce darker meat than did mangolds.

The age of the animal is a more important factor, in determining colour, than the diet, the colour deepening with increasing age. Breed differences also were noted, the meat of the Shorthorn being lighter coloured than that of the two Danish breeds.

Some influence of the feed on the colour of the outer and inner layers of fat was noted, but age appeared to be the more important factor, the fat becoming more yellow with advancing age. Swedes produced slightly darker fat, and grass, clover and alfalfa much darker fat than did mangolds and potatoes. Here again, however, age appeared to be more potent than diet, the fat becoming more yellow with advancing age.

This report also contains interesting data on the daily gains and feed consumption of the varied collection of animals used.

A practical article on the management and feeding of bacon pigs, with special reference to carcase quality, will be found in the 1934 volume of the *Journal of the Royal Agricultural Society* (Ref. 48a).

VI.—Grassland Problems.

Few agricultural problems present greater complexities to

the investigator than that of the assessment of the nutritive value of grassland herbage, since so many factors enter into the determination of the final result. If we mention management, soil, botanical, chemical and meteorological factors, we have by no means exhausted the list. That research all along the line is now in active progress is evident in the literature of the year.

In our own country the examination of the composition and digestibility of the herbage continues to occupy the attention of the Cambridge workers, whilst management and botanical studies are in progress at Aberystwyth, and others are concerned with the allied problem of the efficient conservation of the herbage by artificial drying and ensilage.

The latest report from Cambridge (Ref. 49) deals with the question of the composition and nutritive value of winter pasturage. As was to be expected, the results show marked signs of climatic influence, even though obtained in the mild, open winters of 1931–32 and 1932–33. The material examined was produced by unrestricted growth over the following periods : (1) end July, 1932, to December, 1932 ; (2) end August, 1932, to January, 1933 ; (3) end September, 1932, to February, 1933 ; (4) end October, 1931, to March, 1932.

The December herbage grown in period (1) was essentially leafy in character, but compared with spring grass of similar botanical character it was poorer in protein, lime and phosphorus and richer in fibre and "carbohydrates". Despite its leafy character it had evidently undergone a good deal of lignification, and this was reflected in its relatively low digestibility and nutritive value as compared with spring herbage.

Stage of growth is thus clearly not the sole factor that determines the composition and digestibility of pasture herbage, but meteorological conditions, especially in so far as they affect the rate of growth, must also be taken into account. Cold and frost check growth and induce a premature partial lignification of the grass substance, whereby a reduction of nutritive value ensues. The effects are indeed very similar to those produced by drought in summer, the one difference noted being that the latter raises the lime content whereas this is depressed by winter cold.

The January herbage obtained in period (2), grown from the end of August, was less advanced than the December herbage which had been growing from the end of July. It had withstood the effects of frost better than the latter and was richer in protein, but was still much inferior in composition and digestibility to spring grass of similar height and stage of growth.

The February herbage of period (3), having been produced almost wholly under winter conditions, was still less advanced in growth than the January grass, and again showed the greater

power of young grass to resist frost damage. In composition and digestibility it began to approach more closely to spring and summer herbage than the December and January produce, the digestibility of the fibre being notably improved. This improvement could not be attributed to better weather conditions in February, but was rather to be explained by the very early stage of development of the grasses. This view was supported by the results obtained in period (4) with grass grown from the end of October to March. Despite the prolonged period only a short, leafy growth was obtained and this material was found to approximate very closely in composition and digestibility to the normal spring and summer grass.

Although the herbage produced in the periods (3) and (4) had the highest nutritive values the yields were trivial, and it is suggested that if, under the climatic conditions of East Anglia, an adequate amount of winter grazing is desired, it would be necessary to discontinue the grazing of the pastures at the end of July. It is estimated that under such conditions the pasture used for the experiments would have produced per acre for grazing in December the equivalent of eighty-seven days' keep for an 8 cwt. store bullock putting on 1 lb. live-weight per day.

A special note is made of the fact that the winter herbage, especially after it had been browned by frost, was definitely unpalatable as compared with spring or summer grass, this effect also being less marked with the younger than with the older grass.

The problem of winter keep is also occupying the attention of the Aberystwyth workers in connection with the Cahn Hill improvement scheme (Ref. 50), but the problems involved are more those of cropping and management than of nutrition, and therefore hardly fall within the scope of this review. On the same grounds also only passing mention need be made of recent American comparisons of rotational and continuous grazing of pastures (Ref. 51).

Turning from pasture to hay, American experiments (Ref. 52) have shown that whereas on rations containing liberal amounts of good alfalfa hay without pasture cows maintained their health, milk production and reproductive powers for periods of over seven years, the same was not the case when the roughage consisted of low or medium quality timothy hay. With the latter, milk production somewhat decreased, general health was less satisfactory and reproduction was seriously interfered with. Although the trouble was doubtless in part associated with the moderate quality of the timothy hay used, Canadian experiments (Ref. 53) with pasture grass from fertilized and unfertilized areas raise the possibility that deficiency of protein quality may have been a contributory factor.

VII.—Conservation of Grass.

With the re-discovery in recent years of the high nutritive value of young spring and summer grass, interest has steadily developed in the possibilities of the conservation of such grass for winter fodder either by artificial drying or ensilage.

The former method is now gradually finding its way into farm practice in this country and elsewhere, and its spread is now determined more by economic considerations than by doubts as to the value of the product. Information regarding the losses in drying and the composition and digestibility of the product have been given in previous reviews, but one further example may be quoted from the year's literature.

At the Western Washington Experiment Station (Ref. 54) six digestion and mineral-balance trials were conducted to determine the effect of the temperature of artificial drying on the apparent digestibility and availability of the feed nutrients in three-weeks-old mixed pasture grass, composed of about two parts each of perennial and Italian ryegrass and one part of white clover. The artificial drying was done in an experimental direct-heat rotary single-drum drier, fired with Diesel oil. The herbage passed through the drier in from two to five minutes. Material was prepared with exhaust temperatures of 250°, 300°, 350° and 400°F., and the digestibility of this material and of fresh grass and sun-cured grass was determined in experiments with sheep.

Except for the product dried with an exhaust temperature of 400°, no significant differences of digestibility were found between the sun-cured grass and any of the artificially dried products, both total dry matter and crude protein showing a digestibility of about 76 per cent., and the fibre and nitrogen-free extractives of about 83 per cent. in both cases.

With the grass dried at 400°F. the digestibility of the dry matter, protein and nitrogen-free extractives was rather less, there being a certain amount of burning of the more leafy parts of the herbage at this temperature.

Except for this over-heated sample the digestibility of the dried grass was slightly higher than that of the green grass. Positive balances of nitrogen, calcium and phosphorus were maintained by the sheep on all the rations, and there was no apparent relationship between the average nitrogen balance and the temperature of artificial drying.

Under the conditions of this experiment the percentage of natural colour of the herbage was highest in the sun-cured sample (78 per cent.), whilst in the artificially dried materials it steadily fell with rise of temperature, especially beyond 300°F.

The alternative process of conserving grass by ensilage has been tested at various centres during the past two years, but few reports have yet appeared.

In Irish experiments (Ref. 55) it was found that grass silage of excellent quality could be made in concrete silos from unchaffed material provided that the grass was cut sufficiently early to permit of tight packing.

When cutting was delayed until within about a fortnight of the time when the grass would normally have been mown for hay there was considerable spoilage owing to excessive inclusion of air in the packed material. For a similar reason small wooden silos, which cannot be made perfectly air- and rain-tight, were found unsuitable for Irish conditions.

Comparative tests were made in concrete tower silos of the ordinary method of ensilage against two Continental methods in which, with the object of controlling the fermentation, acid is added during the filling. The two processes used were the A.I.V. process, in which a mixture of hydrochloric and sulphuric acids is used, and the Defu process, in which a mixture of hydrochloric acid, phosphoric acid and sugar (molasses) is added. With both processes a reduction in the loss of dry matter was effected as compared with the ordinary ensilage, but this saving was almost offset by greater spoilage through the increased activities of moulds in the acid-treated silage.

The one definite advantage that appeared to accrue from the acid, or acid and sugar, treatment was a reduction in the breakdown of protein into simpler nitrogenous compounds, which breakdown always takes place in the silo. Doubt is expressed, however, whether this saving is sufficient to compensate for the extra trouble, inconvenience and expense involved in the acid treatment.

In a small-scale feeding experiment with dairy cows no difference in feeding value of the three types of silage could be detected, although the A.I.V. silage was apparently the least palatable.

In a feeding experiment at Dartington Hall (Ref. 56), 40 lb. of A.I.V. aftermath grass silage replaced 40 lb. mangolds, plus 5 lb. hay, without any measurable effect upon the health, live-weight or milk-yield of the cows ; but the colour and vitamin-A content of the butter-fat were much improved.

A brief reference is also made in the 6th Annual Report of the Hannah Dairy Research Institute (p. 9) to comparative metabolism trials with cows on silage made from young grass by the ordinary method, by the A.I.V. process, and by treatment with molasses. No differences were observable in the nutritive value of the three types of silage when these were used as sources of protein for milk production (*i.e.*, as the major part of the production ration). The utilization of the protein of the silage was, in fact, as high as that of fresh spring grass. It is noted, however, that the condition of the cows at the end of the silage periods was not entirely satisfactory.

Unpublished data from experiments carried out at Harper Adams Agricultural College with grass silage made in small wooden silos give general confirmation to the Irish results in showing an appreciable reduction, both in loss of dry matter and in protein degradation, by the A.I.V. process as compared with ordinary ensilage. Treatment with molasses without acid was equally effective in conserving the dry matter, but less so as regards protein breakdown. The molassed silage, moreover, proved the more palatable.

VIII.—Lucerne.

In addition to its cultural virtues the lucerne plant has many valuable dietetic qualities. Along with its familiar richness in protein of high quality it is usually, when in the green state, well equipped with vitamins A, B, and C. In recent work on the last named (see p. 317), lucerne leaves contained on the average four times as much vitamin C as is present in *Citrus* juice. It also contains 1–2 per cent. of mineral salts, of which nearly 0·5 per cent. is calcium; in addition it contains, per gram, about 8 mg. of iron, or nearly double as much as spinach.

Where it can be grown successfully on the farm it is a valuable crop, but investigations at Cambridge which have been noted in previous reviews have raised doubts as to whether its superiority in nutritive value, over young grass, is as great as has been commonly assumed.

A third report from Cambridge (Ref. 57) now gives further information on the composition, digestibility and nutritive value of various lucerne products. The materials examined were lucerne hay made and baled in the field, lucerne hay made in the stack, English heat-dried lucerne meal, American sun-dried lucerne meal, and American sun-dried lucerne leaf meal. It may be noted in passing that the hay from the bales was of much poorer quality than that made in the stack.

The results emphasize the superiority in protein content and digestibility of leaf over stem, and therefore of meal prepared by drying and grinding young lucerne over meals made from lucerne hay. For this reason also the lucerne leaf meal gave the best results, but was not much superior to the English sample made by cutting and drying lucerne at the pre-budding stage of growth. Neither, however, was equal in digestibility and starch equivalent to dried grass made from pasture cut at intervals of one to five weeks.

It was found that lucerne meals could be kept for long periods without deterioration or significant increase in moisture-content if placed in a cool, dry store. For feeding to cattle and sheep it is recommended that the meal be only coarsely ground, but a finer grist may be used for pigs and poultry.

The data obtained for the digestible composition and nutritive value (dry matter basis) of the various meals are summarized below :—

	English Meal first cut in pre-bud.	English Meal second cut in early flower.	American lucerne meal.	American lucerne leaf meal.
	per cent.	per cent.	per cent.	per cent.
Crude Protein	17·5	12·7	9·2	18·0
Ether Extract	1·5	0·7	0·3	—
N-free Extract	31·2	30·6	27·0	34·6
Fibre	10·4	12·3	13·2	8·8
Total Organic Matter	60·6	56·3	49·7	61·4
Starch Equivalent	55·1	48·4	38·9	55·2
Nutritive Ratio . . . 1 :	2·57	3·51	4·44	2·42

The variations between the different products are very great and suggest that lucerne meals should be bought on analysis.

The data for the hay samples indicate that a good grade of lucerne hay, made from a crop in early flower, has a starch equivalent almost the same as that of a good grade of meadow hay. It tends, in fact, to be more fibrous, but it is nearly twice as rich in digestible protein and nearly three times as rich in lime.

Further information on the practical value of lucerne meal and green lucerne for pig-feeding is given in a recently issued Danish report (Ref. 58).

In the meal experiments, which were carried out on four farms with forty-one lots of pigs, varying proportions of lucerne meal were fed along with skim milk and cereal meals, the proportions of the lucerne meal ranging from 1 to 12·6 per cent. of the total ration. The lucerne meal used was comparable in protein content with Woodman's second-cut English, but was rather low in fibre and much higher in mineral matter. The effects, if any, of the lucerne meal supplements at all levels were very small. The same was found also in the experiments with green lucerne. It would appear that only about 10 per cent. of the concentrated food can be effectively replaced by the equivalent food value of lucerne, which would mean about seven times the weight of greenstuff. Possibly the lucerne might have shown to better advantage in rations without milk, and there was some evidence of this when the milk supply was reduced. There was also some evidence of a favourable influence of the lucerne on the grading of the pigs, as judged by the proportion of pigs placed in the first class, but the indications were by no means regular.

IX.—Sweet Lupins.

The lupin plant is eminently suited for light, sandy soils and has been extensively used as a green manuring crop in their reclamation. Its development for the production of seed for

feeding purposes has been hindered in the past, however, by the presence in the seed of a bitter alkaloid, which makes it impossible safely to use the seed for feeding without a preliminary treatment to remove the alkaloid. This treatment is costly and tedious, involving soaking, steaming, and repeated washing with water.

In their search for grain foods rich in protein which can relieve their country of the necessity for importing protein concentrates, German workers now claim to have solved the lupin problem by the creation of new strains of sweet lupins that are free from alkaloid, and can therefore be fed without special preparation. These new lupins, which have been obtained in both blue-flowering and yellow-flowering forms, give seed containing (on dry matter) as much as 45–46 per cent. of protein, 4·5 per cent. of fat and 29 per cent. of carbohydrates, and clearly therefore represent a valuable addition to the pulse crops if their yielding capacity and other growth characteristics prove satisfactory. Digestion trials with sheep, pigs and poultry have all given very satisfactory results (Refs. 59, 60), and in metabolism experiments the biological value of the proteins was found to be fully equal to that of other leguminous seeds (Ref. 61). The yellow variety would appear to be superior to the blue in protein content, an average of about 34 per cent. being quoted for the latter.

X.—Pig-feeding Experiments.

A number of pig-feeding experiments have already been referred to in previous sections, but a few others that deal with matters of interest remain to be noted.

Experimental Methods.

The problem of individual variability in experimental lots was briefly discussed in last year's *Guide*, p. 122 (*Journal*, p. 290), and attention was directed to the growing tendency to abandon group feeding methods in favour of individual feeding.

A complex experiment on the latter lines has been carried out at Rothamsted (Ref. 62). The experiment was planned more from the point of view of the statistician than that of the husbandman and was designed primarily to test the validity and practicability of the methods employed; taking, however, as the basis of comparisons the practical issues of wet versus dry feeding, with and without green food. Although, by the methods used, the degree of variability was reduced considerably below that of group feeding it was appreciably higher than had previously been reported in similar experiments by Dunlop at Cambridge (see *Guide* for 1933, p. 123; *Journal*, p. 291). The practical outcome of the experiment was to show that green food was essential to young pigs under the conditions of the experiment; that pigs on wet mash ate more and grew faster

than on dry meal; and that the effects of numbers in a pen (giving equal floor space per pig) were negligible.

Dunlop (Ref. 63) has further pursued his enquiry into the possibility of reducing the factor of variability in pig-feeding experiments. In his previous work he had demonstrated the importance of food intake and initial live-weight. When these have been controlled there still remains a small degree of variability which he suggests may be mainly attributable to one or more of the three factors: (1) basal metabolism; (2) efficiency of digestion; and (3) the type of energy (*i.e.*, fat or protein) that is being laid down as live-weight increase in the body. From an experimental study of the first and last of these and a review of Woodman's digestibility data, he comes to the conclusion that the third factor is mainly responsible for the remaining variability. When the observed live-weight gains were corrected for the variable proportion of protein to fat in the live-weight increase the variation between individuals was reduced almost to vanishing point.

Sows' Milk.

German data (Ref. 64), based on the records of twenty-two sows, indicate that milk flow was highest in the second and third weeks of lactation, and higher with large than with small litters. The average flow over eight weeks was 3·25 kg. (7·7 lb.) per day. If the supply of protein in the food was inadequate the milk yield fell for the first two weeks and then remained moderately high at the expense of the sow's body-weight. Excessive protein supply on the other hand did no more than maintain the normal flow. The colostral milk (given immediately after farrowing) contained on the average 21·4 per cent. of solids, including 4·6 per cent. fat. During the first week the solids fell to 19·2 per cent. and later to 17·1 per cent. The average fat-content of the normal milk was 6·3 per cent., and protein 5·4 per cent. Production of 1 kg. live-weight gain in the litter during the first four weeks required on the average 2·239 kg. of sow's milk.

An American report on the same subject (Ref. 65) gives the average daily yield per sow for a lactation period of 8–12 weeks as 6·8 lb. The average composition of the colostrum and of the normal milk in this case were as set out below:—

	Colostrum. per cent.	Normal milk. per cent.
Total Solids	28·02	17·98
Fat	5·96	6·77
Proteins	15·49	6·22
Ash	0·65	0·97
Calcium	0·076	0·252
Phosphorus	0·083	0·151

The change from colostrum to normal milk was rapid, and there appeared to be a steady rise in the ash, calcium and phosphorus from farrowing to the end of lactation.

"Physin" Needs of the Young Pig.

The remarkable growth rates obtained occasionally with some litters of pigs are difficult of explanation in terms of supply of protein, vitamins, minerals and energy, and are suggestive of the existence of some essential food factor, as yet unidentified, that in these exceptional cases is supplied to the young pig before or after birth, but is more frequently liable to be deficient. The probability of this has been demonstrated experimentally by Dunlop (Ref. 66) using additions of raw minced liver to rations which were to be regarded as adequate as far as our present knowledge of essential dietary constituents goes. The increase in growth rate effected was as much as 40 per cent. over that of the "control" pigs. The presence of a new accessory factor in liver was first demonstrated by Mapson in 1932 (see *Guide* for 1932, p. 128 ; *Journal*, p. 288) and provisionally termed by him "physin." It is present in milk, and Dunlop suggests that it is the primary cause of the specific growth-promoting property of milk. It is present in minute amounts in other foodstuffs, which Dunlop arranges in the following order of decreasing potency with regard to physin : liver, liver meal, dried whole milk, whey, green food, fish meal, meat meal, extracted soya bean meal.

Value of Pasturage.

In a Harper Adams College experiment referred to last year (*Guide*, p. 160 ; *Journal*, p. 328), newly weaned pigs were found to derive benefit from summer pasturage as compared with similar pigs confined to sties. In a second experiment on similar lines now reported (Ref. 67), in which the grazing took place under rather trying autumn conditions, the advantage was found to lie with the confined pigs.

In an experiment at Aberdeen with winter grazing (Ref. 68), the outdoor pigs showed to advantage, as was also the case for both autumn and summer in similar experiments reported from California (Ref. 69).

Although the balance of evidence in these experiments is in favour of pasturage there is sufficient evidence of divergence of experience to suggest that any generalizations must be tempered by due regard to local and climatic conditions.

In the Aberdeen experiment the average thickness of back-fat was distinctly less on the outdoor pigs, but the numbers of animals compared were so small that the results scarcely do more than point to the need for further investigation.

Rationing of Food.

The Aberdeen report also gives a summary of results obtained in a comparison of *ad lib.* feeding with the supply of the same food mixture in rationed quantities, starting with 2 lb. for the 40 lb. pig and rising by ¼ lb. per pig each week up to a maximum daily ration per head of 6 lb. The average amount of food consumed per pig in growing from 40 lb. to 200 lb. live-weight was 652 lb. for the *ad lib.* group and 561 lb. for the rationed group, but the latter required an average of ten days longer to reach the 200 lb. weight. The extra cost of labour, etc., involved in this extra period would be trivial, however, in comparison with the saving of food. The rationed pigs, moreover, showed to advantage in the carcase grading, both as to back-fat and thickness of streak. Evidence confirmatory of this was also obtained in a second experiment.

That restricted feeding may affect the protein requirement of the pig at different stages of growth appears to be probable from Canadian experiments (Ref. 70). During the first thirty days after weaning a ration containing 17 per cent. of protein was found to be the most satisfactory, whether the pigs were full-fed or half-fed. For the following thirty days a level of 14 per cent. protein was adequate for the full-fed pigs, whereas the half-fed pigs still used their food to slightly better advantage when the protein was kept at 17 per cent. After sixty days the 14 per cent. level proved adequate for both lots. It may be further noted from this report that full feeding resulted (for all periods and groups) in 60 per cent. faster growth than half feeding and the food utilization value was no worse.

At the Harper Adams College no difference was found in the effect on live-weight gain of feeding twice and thrice daily (Ref. 67).

Meat Protein and Bone Protein.

The protein of meat has a higher "biological value" than that of bone, but is not necessarily superior to it in its power of supplementing the proteins of the rest of the ration in which the meat and bone may be incorporated. Evidence on this point has been sought in four practical feeding experiments reported from the Harper Adams College (Ref. 67), in which meat meal and whale meat, each free from bone, have been compared with commercial meat meal (55 per cent. protein) containing a considerable proportion of bone. The quantitative differences recorded in the four pairs of comparisons varied considerably, but were in agreement in showing a tendency for more rapid growth to be made with the meat proteins than with the mixed meat and bone, especially in the earlier stages of growth of the pig. A tentative estimate is given that the "unit value" of

meat protein may be taken as being about 10 per cent. higher than that of the mixed proteins in commercial meat meal. The basal rations with which the protein concentrates were used in these experiments consisted of sharps, barley, maize, wheat and tapioca meals, together with a little limestone and salt.

Bran.

The Aberdeen report (Ref. 68) gives a summary of the results of two experiments in which different proportions of bran, ranging from 10 per cent. to 30 per cent., were incorporated in rations of sharps, barley, maize and fish meals. In all cases the inclusion of bran lowered the average rate of live-weight gain and the efficiency of utilization of the ration, the depressant effect steadily rising with increase in the proportion of bran used. With about 10 per cent. the effect was only small, but this appears to be about the limit to which the inclusion of bran in pig rations can be justified on grounds of direct nutritive value.

Herring Meal.

Current views as to the unsuitability for pig-feeding purposes of fish meals rich in oil and salt, and of strongly flavoured fish meals of all descriptions, receive little support from recent German experimental work, some of which has been noted in past reports (see *Guide* for 1932, p. 143; *Journal*, p. 303 ; 1933, p. 159; *Journal*, p. 327). A further report (Ref. 71) gives data from experiments at seven centres, at each of which comparisons were made of herring meals (1) rich in oil and salt; (2) poor in oil and salt; (3) rich in oil, poor in salt; and (4) poor in oil and rich in salt. The oil-rich meals contained 9–22 per cent. oil and the salt-rich meals 9–12 per cent. salt. A fixed daily supply of about 300 gms. (about 10 ounces) herring meal per pig was fed throughout, the rest of the food consisting mainly of ground cereals and potatoes. The rates of live-weight gain were almost uniformly good in all groups at each centre, and out of eight experiments the greatest gain was obtained in seven cases with the meal rich in both oil and salt. In five cases the meal rich in oil but poor in salt surpassed the meals poor in oil. There could be no doubt therefore as to the superiority of the oil-rich meals in producing live-weight gain.

Similarly in five cases the salt-rich, oil-poor meal surpassed the salt-poor oil-poor meal. In no case could any detriment be observed from using meals containing about 10 per cent. of salt.

Whether judged by inspection or by physical and chemical criteria, no significant differences could be found in the quality of the lean and fat of the carcases, except that the fat from the oil-rich rations was tinged slightly yellow. Further experiments have confirmed these observations, but have brought out the

further fact that although the bacon and hams may show no taint, the livers and brains, especially from pigs fed on the oily rations, may develop a strong fishy flavour when cooked in certain ways.

From Scandinavian experiments also the possibility of producing untainted bacon from herring-fed pigs is claimed.

To our English ideas these results are surprising, and bearing in mind the enormous efforts to stimulate the use of home-produced foodstuffs now being made in the countries from which the reports come, one is inclined to suspect that the standard of flavour regarded as satisfactory may not have been as high as an entirely unbiassed judgment would have set it. Moreover, in discussing the question of bacon quality in a previous section (p. 327) it was pointed out that a final opinion on bacon taints can only be given after prolonged storage of the product.

That the possibility of producing fishy taint in animal produce is by no means restricted to the consumption of fish products is now well known. In this country fishy taint in milk has been traced in certain cases to the use of molassed beet pulp under certain conditions, and recent Swedish investigations (Ref. 72) showed that it might arise through excessive feeding of young clover, lucerne and fresh sugar-beet tops.

XI.—Miscellaneous Experiments.

Oily Food and Milk Secretion.

Reference was made last year (*Guide*, p. 139; *Journal*, p. 307) to American experiments in which a marked increase in the fat-content of milk was claimed from the addition of various oils to the ration, whereas in Irish tests no such improvement had been obtained, such being indeed the common experience within the range of oil feeding that is usual in practice. From another American quarter (Ref. 73) data are reported showing no significant difference in the milk and fat yields of cows receiving a 4 per cent. food-oil level in the concentrate mixture and others receiving oil levels ranging from 6½ to 7 per cent. There was no evidence that the level of food-oil intake had any influence on the percentage of fat in the milk.

Diet and Wool Production.

In discussing this subject in last year's review (*Guide*, p. 135; *Journal*, p. 303), attention was drawn to the possibility of increasing wool production either directly by increasing the supply of the sulphur-containing amino-acid, cystine, in the food protein, or indirectly by more liberal feeding of carbohydrates. This double possibility has now been confirmed experimentally.

In Australian experiments (Ref. 74) with merino sheep on a low protein diet the addition of cystine to the diet resulted in a material increase in wool growth, whilst an even more striking increase was obtained when the cystine was injected subcutaneously with a view to avoiding waste of cystine by the attacks of bacteria in the alimentary canal.

The observations at Aberdeen of the possibility of securing extra wool growth on young Cheviot sheep by adding carbohydrate to a maintenance ration, that were referred to last year, have now been confirmed by a further experiment (Ref. 75). In this experiment the addition of 1 lb. of maize starch per day to the maintenance diet of growing Cheviot sheep doubled their wool production, the increase being chiefly due to increased thickness of the individual wool-fibres.

Sheep-feeding.

The scanty literature of sheep-feeding experiments has been increased by a report on experiments carried out in 1933–34 at the Auchincruive (Ref. 76) farm of the West of Scotland Agricultural College. In comparisons of palm kernel, cottonseed and groundnut meals incorporated in the ration to the extent of 37½ per cent., little difference was found in their effects on the rate of live-weight gain, despite their widely differing protein-content. There were indications of a slight superiority of the groundnut meal, especially in the indoor feeding trial.

Dried sugar-beet pulp successfully replaced swedes in the proportion of 1 lb. pulp for 7–8 lb. swedes. As much as 2 lb. of dry pulp daily could be fed provided the sheep had access to water.

Silage proved rather less suitable for fattening hoggets than swedes or beet pulp and it is recommended that not more than one-half of the swede allowance should be replaced thereby.

A daily allowance of 2·4 lb. dry matter appeared to satisfy fully the appetites of half-bred hoggets of about 80 lb. live-weight. This conforms closely to the standard of 2·6–3 lb. per 100 lb. live-weight arrived at from the Oxford experiments (*Guide* for 1932, p. 147 ; *Journal*, p. 307).

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SOILS AND FERTILIZERS.

FERTILIZERS.

BRITISH farmers have continued to use large quantities of fertilizers in spite of the general depression: it seems clear that they are feeling confident about the future of agriculture. The makers of sulphate of ammonia have felt able to raise the price to a more remunerative level: the basis of the spring price was for 1934, £7 5*s.* per ton as compared with £6 10*s.* and £5 5*s.* for the two preceding years. This, of course, affected the sales, and the agricultural consumption, which in 1932–33 had been nearly 239 thousand tons, fell to nearly 211 thousand tons. Farmers bought more of other nitrogenous fertilizers, however, and the total nitrogen used agriculturally was 55,500 metric tons in 1933–34 against 58,300 metric tons in 1932–33, a fall of 2,500 metric tons or less than 5 per cent., which must be regarded as satisfactory. Taking the world as a whole the production of nitrogenous fertilizers has continued to expand since 1931–32, when it sank to a rather low level. The output of Chile nitrate has increased, as also has that of the concentrated mixed fertilizers: the American output has expanded but, taking the world over, the synthetic nitrogen plants are still working at less than half their capacity. Great Britain is one of the largest exporting countries, being beaten only by Germany; and our principal customers are Japan and Spain, followed by India and Portugal, then the Canary Islands and Ceylon, and a number of smaller purchasers.

The concentrated nitrogenous fertilizers.

Modern methods of making fertilizers allow of the production of much more concentrated preparations than used to be possible.

The new fertilizers are based on either mono-ammonium phosphate (12·2 per cent. N, 61·7 per cent. P_2O_5) or diammonium phosphate (21·2 per cent. N, 53·8 per cent. P_2O_5): the former is used by the English and American makers, the latter by the Germans (Nitrophoska). Both substances are more concentrated than the ordinary fertilizer and thus their use saves carriage and cartage on the farm; they are also very intimately blended and in good physical condition so that they can be well distributed.

Frequently they are mixed with potassic salts so as to make the fertilizer complete; some of the forms common in England have the following percentage analyses:—

Nitrogen (N).	Phosphoric Acid (P_2O_5).	Potash (K_2O).
10·4	20·5	10·4
12·5	12·5	15·0
10·4	10·4	20·8

The differences between these and the ordinary fertilizer mixture is that they contain no gypsum, which is present to a

considerable extent in superphosphate. This gypsum or calcium sulphate is known to be useful under some soil conditions, and where it is needed the older fertilizers would have the advantage. Many experiments have been made in different parts of the British Isles by A. H. Lewis, Miss Sinclair and D. Trevains (Ref. 1), and these showed that the phosphate of ammonium phosphate may be in some cases more available than that of calcium phosphate, but on the other hand part of the ammonium phosphate may be toxic to plants, especially on sandy soils deficient in calcium. For example, the ordinary fertilizers proved better than the concentrated ones for mangolds on certain acid sandy soils though the difference disappeared when gypsum was added. But apart from these few cases the old fertilizers and the new were alike in their effectiveness on the crop, and the choice is therefore determined by convenience of use.

Calcium Cyanamide.

This fertilizer has been studied a good deal at Rothamsted during recent years and the results obtained have been published in a series of papers by H. L. Richardson and E. M. Crowther (Ref. 2). Those of more practical interest are set out below.

Calcium cyanamide is not a direct plant nutrient but, on the contrary, a plant poison. In the soil it is changed first to urea and then to ammonia, the change generally being complete in a few days. Subsequently the ammonia nitrifies in the usual way, but there may be a delay with heavy dressings on certain soils through the action of the cyanamide and its by-products on the nitrifying organisms.

As a fertilizer cyanamide should be applied a few days, or a week or two (for heavy dressings), before sowing the crop, and well harrowed into the soil. It then usually acts as rapidly as sulphate of ammonia, and gives crop increases of about the same size; sometimes however, it is less effective.

It contains lime and does not tend to make the soil acid even when used repeatedly on the same land. For this reason it is preferred to sulphate of ammonia in some wet regions where soils tend to be acid, such as the North of Portugal.

Its toxic properties are turned to good use for weed control, *e.g.*, against charlock in spring corn, or chickweed in asparagus beds; having destroyed the weeds, it changes to a nitrogenous fertilizer. A dressing of about 1½ cwt. per acre is used for charlock; this does but little damage to the narrow, vertical leaves of the cereal. Sometimes, however, the weeds may recover; the result depends on the weather, the size of the plants, etc. For chickweed in asparagus beds much heavier dressings (5 to 10 cwt. per acre) are used, and these are remarkably effective, killing all the weeds without injuring the asparagus (Ref. 3).

On exposure to the air, cyanamide slowly changes into compounds of lower fertilizer value. If it has to be stored, therefore, it should be kept in a dry place, unopened, in the paper-lined bags in which it is supplied. When mixed with superphosphate, a similar breakdown takes place to some extent: this mixture should be avoided as far as possible. If it must be made the mixture should be spread at once in a thin (1 inch) layer to cool, and applied soon afterwards.

A grave disadvantage of cyanamide in the past has been the disagreeableness of the task of spreading it, owing to its fine dusty state. A German process of granulation has been established which is claimed by H. Kappen (Ref. 4) to be the greatest advance made since the industry began. Practical men who sowed the new material declared that they would sooner do so for a whole day by hand than drill the ordinary form for an hour, no matter how good the drill or how generous the provision of special clothes.

During this work, Richardson and Crowther observed that cyanamide caused more tillering of barley on rich soils than other nitrogenous fertilizers: this they regarded as showing that the ammonia formed from the cyanamide is more rapidly utilized than a corresponding quantity of nitrate would have been.

The Source of Nitrogen for Plants.

The old question whether plants can take up nitrogen compounds other than nitrates (which are usually regarded as their best food) is being investigated once more. Each generation of workers reopens this question, and always with the same result: other nitrogen compounds can be assimilated and they are assimilated under sterile conditions. But no nitrogen compound has yet been found more efficient as a fertilizer than a nitrate, and so for the present the practical position remains as it was. Of the recent investigations those of Virtanen (Ref. 4 and 5) and of Prianischnikov (Ref. 6) are among the most important.

Phosphatic Fertilizers.

The consumption of superphosphate in Great Britain and in the world at large was greater in 1934 than in 1933, when, in this country, it had fallen below the usual level.

Value of Superphosphate in warm dry conditions.

During the elaborate series of barley trials carried out from Rothamsted under the ægis of the Institute of Brewing Research Scheme it was observed that barley responded to superphosphate more usually in Norfolk than in other parts of England. Observations in other parts of the world show that superphosphate is often specially advantageous for cereals under warm dry conditions,

In many parts of Australia and Canada wheat receives nothing else. The general rule is that under conditions of low rainfall superphosphate alone suffices, while in regions of higher rainfall (as in this country) nitrogen also is needed, and the higher the rainfall the greater the need for nitrogen. The is well seen in the following results obtained in the province of Manitoba on the Canadian prairies (Ref. 7):—

FERTILIZER REQUIREMENTS FOR WHEAT IN MANITOBA, 1929-31.

District.	Soil Type.	Type of Fertilizer	Ratio P_2O_5/N.
Southern belt.	Black prairie soil (Chernozem).	Triple Superphosphate.	No Nitrogen.
Intermediate belt.	Transitional.	Monoammonium phosphate.	5·1
Northern belt.	Forest or recent woodland (podsolized).	Diammonium phosphate.	5·2

Remarkable results are obtained in some of the drier regions of the world from small dressings of superphosphate, provided it be so supplied that the plant roots can easily get at it. In South Australia the average results have been, in bushels per acre (Ref. 8).

Mean yield of Wheat.			Bushels per acre. Quantity of 36% Superphosphate applied per acre.			
Location.	Rainfall inches.	Period Years.	0	½ cwt.	1 cwt.	2 cwt.
Roseworthy .	17·85	17	11·2	16·4	17·9	17·8
Booborowie .	17·62	13	19·5	24·5	26·4	28·1
Mannipa .	13·81	13	12·2	16·5	17·7	19·0
Veitch . .	12·08	14	12·7	13·7	15·3	16·4

Marked increase in pastures grass are also obtained by means of superphosphate.

On the Canadian prairies striking increases in wheat yields are given when the superphosphate is drilled with the wheat, *i.e.*, seed and fertilizer in separate boxes on the drill but passing down the same spout. The effects are less clear when the superphosphate is broadcast separately.

Results of this kind are being obtained in a number of places. To ensure success, however, the fertilizer must be so placed that the young plant can obtain it quickly; the position of the fertilizer in the soils is more important than is generally realized. Many people suppose that, so long as the fertilizer is harrowed into the soil, nothing more is needed: there is growing evidence that this is not enough, but that the fertilizer should be placed near the seed.

Basic slag and mineral phosphate.

The results of a large number of field experiments with basic slag and mineral phosphates have now been summarized by E. M. Crowther (Ref. 9). This is the best account yet presented

of recent work on the subject and it brings into one paper a great amount of information not otherwise easily obtainable. The value of the citric acid test for discriminating between the various slags is emphasized. It is shown, too, that mineral phosphates are more useful on acid soils than on neutral ones: both in Germany and in Russia this rule holds fairly well. Probably the conflicting results obtained in this country would be explained if the reaction of the soil had always been determined.

Soils from which plants have difficulty in obtaining phosphorus.

There are some soils from which plants have considerable difficulty in obtaining the phosphorus they need. Soils containing much iron oxide, such as the red soils of hot countries and some soils of temperate regions, suffer from this disadvantage; the iron oxide easily combines with phosphoric acid and fixes it so firmly that plants cannot extract it. Phosphatic manures such as superphosphate have but little effect because it is the soil and not the plant that fixes and holds the phosphate. So far no simple and effective method has been devised for overcoming the difficulty though many experiments are being made.

Another case, also difficult though it seems more promising, is that of calcareous soils. Breazeale and McGeorge (Ref. 10) in Arizona show that phosphate is fixed in presence of calcium carbonate to form a very insoluble substance which is not likely to be of any use to plants. This may easily happen if the soil reaction is slightly alkaline (pH above 7·6). Field experiments are now being tried to see if the phosphorus can be made more available by reversing the conditions and moving the soil reaction locally towards slight acidity. The particular method tested is to grow green crops and plough them in, so that a good deal of carbonic acid may be generated in the soil itself. If this answers it will be quite a useful procedure.

Effect of lupins on the uptake of phosphorus by plants.

Lupins are known to be of great value as green manure on light sandy soils, but they have also another good quality which is not so familiar to farmers. They are better able than most other crops to extract phosphate from the soil. Having done this they store it in their leaves and other organs and when the crop is ploughed into the soil the phosphate becomes more available for the next crop than it otherwise would have been. This property was recognized in Germany during the War when phosphatic fertilizers were very short, but it has recently been studied more fully. Domontovich, Shestakov, and Polossin (Ref. 11) found that oats grown in association with lupins took up more phosphate from mineral phosphate than when grown

alone. It may be supposed that the lupins dissolved phosphates which would otherwise have remained inaccessible to the oats.

Poultry Manure.

The marked increase in the number of poultry in this country has brought into prominence an old question which has never yet been thoroughly examined: how does poultry manure compare with equivalent amounts of artificials? In 1933, the Ministry of Agriculture set up a small committee to study this question, the experimental work to be done under the supervision of the Rothamsted staff. The manure was dried and prepared in a form in which it could be transported easily as a commercial product: the analysis of the samples ranged between the following limits:—

	1933.	1934.
Moisture	5·8	8·4
Nitrogen (N)	3·6–4·4	2·6–3·3
Phosphoric oxide (P_2O_5)	2·9–4·0	3·2–3·8
Potash (K_2O)	1·6–1·9	1·6

The experiments were made usually on market gardens with market garden crops as it seems probable that gardeners would make more use of poultry manure than farmers.

The general result, both in 1933 and 1934, is that poultry manure in its first year is less effective than sulphate of ammonia; little evidence could be found that it is ever superior. At a number of centres neither manure was effective—apparently because the ground was already in such high condition that even nitrogen failed to act.

The average results for potatoes at the thirteen centres in which 3 cwt. per acre sulphate of ammonia was compared with the equivalent amount of poultry manure (approximately 1 ton) were as follows (Ref. 12):—

Potatoes, tons per acre. Mean of 13 experiments. 1934.

No Nitrogen	8·17
Poultry Manure 0·6 cwt. Nitrogen per acre	8·83
Sulphate of Ammonia, 0·6 cwt. Nitrogen per acre	9·53
Poultry Manure + Sulphate of Ammonia (1·2 cwt. N in all)	9·53
Mean	9·02
Standard error	±0·132

There was no evidence that the poultry manure fortified the effect of the sulphate of ammonia; indeed the average response to poultry manure was less in the presence than in the absence of sulphate of ammonia.

On the other hand there was some evidence of a cumulative effect of poultry manure; a dressing given in 1934 to land which had also received it in 1933 was more effective than sulphate of ammonia.

SUBSTANCES STIMULATING OR OTHERWISE IMPROVING PLANT GROWTH.

Everyone has heard of vitamins for human beings and animals, and periodically it is claimed that something has been discovered which plays a similar part in plant growth. Reference was made in the last report to the effect of certain elements needed in small quantities only, yet vital to the plant, *e.g.*, boron and manganese. Other instances can now be recorded. The need for zinc in certain conditions for pecan and for citrus trees has been emphasized; in California a leaf-mottling disease of citrus trees has been attributed to a lack of zinc, though instead of supplying the deficiency by adding zinc to the soil it is found cheaper and equally effective to spray the trees with a zinc wash made up like Bordeaux mixture, but with zinc sulphate in place of copper sulphate. Whether this is a true case of making good a deficiency, or of a curative action, is not yet clear. The disease occurs on alkaline soils (pH 8·3) where inorganic nitrogenous manure is given. It does not occur where organic manure is supplied.

Lithium salts are stated by Sir Rowland Biffen to confer resistance to mildew and yellow rust on wheat grown in pots.

Molybdenum salts injected into plants have been found by Miss Sheffield (Ref. 13) to induce a trailing habit of growth and also to produce the symptoms of virus disease in *Solanum nodiflorum*. W. A. Roach (Ref. 14) shows that the roots of fruit trees vary in their power of assimilating molybdenum from the soil; some can do it and others cannot.

Some of these curious stimulating substances are organic. They were first called *auximones*, but, owing to the difficulty of working with them it has not always been possible to distinguish their effects from those of the inorganic promoters, and some of the auximone effects of the older workers are probably attributable to iron. But there are cases where the active agent is probably an organic substance, though owing to difficulties of working it is not possible to be quite sure. F. W. Went and Kögl (Ref. 15) have recently isolated from the growing point of plants an auxin which increases the growth of the upper parts by stimulating the elongation of the cell, and restricts the growth of the roots; they have gone so far as to ascribe the formula $C_{18}H_{32}O_5$ to one form of the auxin and $C_{18}H_{30}O_4$ to another.

A remarkable substance has recently been obtained by H. G. Thornton at Rothamsted. The invasion of the root hairs of leguminous plants by the nitrogen-fixing bacteria is preceded by an excretion from the roots, which causes the bacteria in the soil to multiply. In turn the bacteria excrete something which causes the root hairs to multiply and to curl;

on the inner bend of the curl the bacteria enter. The properties of this substance are being studied.

Whether any of these substances is likely to be of fertilizer value, or to have any practical application in agriculture or horticulture, is not yet clear. The important thing at the moment is to obtain full information about them; first to get the facts and then to see whether they can be put to any use. In some preliminary investigations, Havas and Caldwell (Ref. 16) obtained no benefit from the addition of some of the animal hormones to the nutrient mixture for the plant. Nor could Siddappa and Subrahmanyan find any beneficial effect of small quantities of the organic constituents of dried blood, yeast, or farmyard manure on the growth of barley in sand-cultures (Ref. 17).

Fruit Trees.

Wallace (Ref. 18) has shown that potassic and nitrogenous fertilizers are, as a rule, the most important fertilizer elements for fruit, phosphate being advantageous only for cover crops and for strawberries. In all fruit areas in England the potassium supply is the key to the successful nutrition of fruit trees, and by extending the use of potassic fertilizers it has been possible to extend fruit growing and greatly to improve the yields and the quality of the fruit from existing plantations. Trees suffering from shortage of potassium show a curiously high phosphorus content.

Experiments by the East Anglian Institute of Agriculture have given further confirmation of the observation that fruit trees lacking potash suffer from leaf scorch, and that the trouble is cured by adding sulphate of potash (Ref. 19).

Barley.

An important conference was held at Rothamsted in October, 1934, to enable the barley buyers and the barley growers to meet on neutral ground and discuss a collection of samples of malting barley—some 200 in number—sent in from various parts of the country. The samples had previously been graded into seven classes; they were numbered and exhibited in their classes, each farmer being told his own number. 1934 was a poor season for malting barley; nevertheless the judges were able to show that a number of samples would have been better placed had it not been for avoidable faults in treatment. Premature harvesting, faulty stacking and wrong setting of the threshing machine had been responsible for a certain amount of low grading. The Conference will be repeated in November, 1935.

N. N. Ivanov (Ref. 20) has made an extended investigation of the effect of soil and climatic conditions in Russia on the growth of barley, and it is interesting to find that the results

agree in many ways with those obtained at Rothamsted. He finds that barleys of low nitrogen content are obtained under conditions of higher rainfall, while barleys of high nitrogen content are obtained when the rainfall is low. Winter barleys generally have lower nitrogen content than spring barleys.

Sugar Beet.

The average yield of sugar beet in England is lower than in some of the Continental countries and there is urgent need to raise it. But how to do this is not at all clear, because sugar beet does not respond as readily as mangolds or potatoes to the ordinary manurial treatments. In the 1934 experiments organized from Rothamsted (Ref. 21) and carried out on a number of sugar beet farms, twenty-seven different combinations of artificial fertilizers in dressings ranging up to 12½ cwt. per acre of the complete mixture were tested at fifteen different centres, but the results were only small; the effect of manures was on the average:

Mean yield per acre. Washed roots. tons.	Mean yield per acre. Sugar. cwt.	Increase in sugar in cwt. per acre for 4 cwt. sulphate of ammonia	Increase in sugar in cwt. per acre for 6 cwt. superphosphate	Increase in sugar in cwt. per acre for 2½ cwt. muriate of potash.
13·47	47·6	+3·0	+0·9	+0·4

	Sulphate of ammonia.			Superphosphate.			Muriate of potash.		
Cwt. per acre	0	2	4	0	3	6	0	1¼	2½
Roots, tons per acre	12·9	13·5	14·0	13·3	13·4	13·6	13·4	13·6	13·4
Tops, tons per acre	9·6	10·7	12·3	10·7	10·9	11·0	10·9	10·9	10·8
Sugar, per cent.	17·9	17·7	17·5	17·7	17·7	17·7	17·6	17·8	17·8
Sugar, cwt. per acre	46·0	47·8	49·0	47·1	47·5	48·2	47·0	48·4	47·4
Purity per cent.	88·9	88·3	88·0	88·4	88·4	88·4	88·4	88·5	88·4

Of these increases only that given by the sulphate of ammonia is of much significance. Nitrogenous manure almost always increased the tops, but it did not increase the roots to the same extent; it depressed the sugar content and the purity of the juice, but to a less degree. The gain in roots more than compensated the loss in sugar percentage, so that a net gain of 3 cwt. per acre of sugar was obtained on the average by the use of 4 cwt. sulphate of ammonia. The response differed at the different centres: at only half of them was it significant; it amounted on the average to a gain of only 6 per cent.; the gain is, however, profitable and the effect is greater than in 1933. The mineral fertilizers were almost ineffective: 6 cwt. per acre of superphosphate added on an average less than 1 cwt. sugar per acre; it gave significant increases at one or two centres only, the increase amounting to rather less than 3 cwt. sugar per acre. Potash was of no direct benefit; indeed, at one centre it appeared to depress the yield of roots; it tended slightly to raise the sugar content, especially when in combination with nitrogen.

It is difficult to understand why the potash and phosphate should have so little effect, and experiments are being made both at Woburn and at Rothamsted to seek an explanation. It is possible we are not giving them in the right way or at the right

time. Experiments are being made under the ægis of the Sugar Beet Factories and the Ministry of Agriculture, which it is hoped will clear up these problems.[1]

Farmyard manure acted as if its nitrogen had less than half the effectiveness of that in sulphate of ammonia, but as it did not depress the sugar percentage its production of sugar was better than that suggested by the yield of roots. Thus, in a comparison between 10 tons of dung and 3 cwt. sulphate of ammonia the results were :—

	Dung.	Sulphate of ammonia.
Approximate quantity of nitrogen in manure, lb. per acre	150	70
Mean increase in yield of washed roots, tons	1·26	1·61
Mean increase in yield of tops, tons	2·08	4·60
Mean effect on percentage of sugar	−0·06%	−0·38%
Mean increase in sugar per acre, cwt.	4·1	4·4
Mean effect on plant numbers, thousands	+2·4	−1·6

The yield and sugar content of the roots depends upon the spacing, but the effect varies with the season. In 1933, with a rather small crop, 10 in. spacing gave much higher yields and somewhat higher sugar content than 20 in. spacing ; in 1934 there was very little difference, but at Rothamsted 20 in. spacing was somewhat the better and at Woburn 15 in. spacing.

Variations in soil conditions have a very great effect, however, on the yield of sugar beet ; the results on different fields at Rothamsted and at Woburn have been (in tons per acre) :—

	Rothamsted Long Hoos 6-course.	Rothamsted Pastures field.	Woburn 6-course.	Woburn Butt Furlong
1933	2·13	6·52	9·15	—
		Long Hoos		
1934	11·08	15·36	9·73	18·45

Our numerous experiments on sugar beet at outside centres have shown that a number of the soils need lime. In view of the fact that lime is easily obtained from the factories this

[1] The corresponding problem on the Continent appears to be simpler. L. Decoux and J. Vanderwaeren have published the manurial recommendations drawn from the experiments at the Tirlemont Sugar Beet Experiment Station in Belgium, and they are quite definite and clear cut (Ref. 22). The fertilizer is recommended to supply per acre : 80–90 lb. nitrogen (N), 40–55 lb. phosphoric acid (P_2O_5) and 110 to 140 lb. potash (K_2O). If no farmyard manure has been applied during the preceding autumn the dressing should be (per acre) 540 lb. Chilian nitrate of soda, 360 lb. superphosphate and 360 lb. muriate of potash—(virtually 5 cwt. nitrate of soda, 3¼ cwt. superphosphate and 3¼ cwt. muriate of potash per acre). These dressings can, however, be halved where a dressing of 12 tons of farmyard manure has been given.

The German sugar beet research station at Bernburg, and the Belgian station at Tirlemont, are described in a recent issue of *Superphosphate* (Ref. 23).

deficiency should at once be remedied; sugar beet is very sensitive to soil acidity and yields fall quickly as soon as acidity sets in.

Potatoes.

The manurial experiments on potatoes were continued at Rothamsted, Woburn, and at outside centres chiefly in the Fen district; some striking results were obtained (Ref. 24). In one series of experiments three levels of manuring with artificial manures were tested in twenty-seven different combinations; no dung was used, as this is not generally available on the fen farms. The results were :—

	Standard error.	Sulphate of ammonia cwt. per acre. None	2	4	Superphosphate cwt. per acre. None	4½	9	Sulphate of potash cwt. per acre. None	1½	3
Light peaty fen.										
Wissington . .	±0·386	8·25	9·07	9·18	6·99	9·67	9·83	6·04	9·58	10·88
Thorney . . .	±0·560	6·79	7·62	9·10	7·59	7·66	8·26	6·79	8·13	8·59
Clay fen.										
March . . .	±0·403	7·56	9·09	10·49	7·00	9·49	10·65	8·80	8·76	9·59
Little Downham .	±0·205	12·89	14·94	16·04	11·73	15·50	16·64	14·18	14·85	14·84
Silt.										
Wisbech . . (early potatoes).	±0·138	5·98	7·11	7·15	6·49	6·76	6·98	6·68	6·74	6·83

The effect of superphosphate is as marked as that of nitrogen and the response continues even to the larger dressing. On the light peaty fen, potash also produces a marked increase, but on the clay fen its effect is less. The early potatoes on the silt soil at Wisbech was less responsive, but still gave definite responses to superphosphate and sulphate of ammonia.

At one fen centre, Wimblington, March, on a light fen soil, the effect of adding dung was tested. Sulphate of potash gave marked responses even in the presence of dung; sulphate of ammonia was less effective. The dressing of 2¼ cwt. each of sulphate of ammonia and sulphate of potash with superphosphate proved nearly as effective as 8 tons of dung per acre. The increases were :—

	Mean Effect.	Dung Absent.	Dung Present.
Sulphate of ammonia, 2¼ cwt.	0·56 tons	0·29	0·83
Sulphate of potash, 2¼ cwt.	3·80 ,,	4·93	2·68
Dung 8 tons . . .	5.00 ,,	—	—
Standard errors . .	±0·177	±0·250	

Blenkinsop (Ref. 25) has made the interesting observation that a certain type of "potato sickness" in Devon and Cornwall is cured by heavy dressings of sulphate of potash. He supposes that the balance of phosphate and potash has been thrown out and that the large dressing was needed to put it right.

Grassland.

The purchase of the farm, park, and house at Rothamsted enabled the experimental farm to acquire a considerable area of

worn out grassland, so that Rothamsted is now in a position to extend the experimental work on this subject. Three methods of improvement will be tried: manuring; cultivating; and organized grazing.

The manuring experiments in the past have been mainly concerned with basic slag, and their general result has been that the effectiveness of the slag increases with increasing solubility in citric acid; the 80 per cent. soluble slag is considerably more efficient than the 26 per cent. soluble slag. But the experiments have also shown that the full improvement of the pasture land is not obtainable unless the grazing is sufficiently heavy to keep the grass down.

Although it deals only in a general way with manuring, Prof. Stapledon's paper before the Farmers' Club must be specially mentioned for its vigorous discussion of grassland problems (Ref. 26).

A. W. Oldershaw has summarized the results of thirty years' experiments on grassland at Saxmundham; considerable improvements have been brought about by soluble phosphates (Ref. 27).

R. O. Davies and H. G. Chippindale (Ref. 28) show that grasses and wild white clover lower the acidity of soil and drainage water from *Molinia* pastures. Basic slag in the ordinary dressings has but little effect on the soil reaction, but its indirect effect is considerable in that the increased herbage growth which it encourages has a decided influence in improving the reaction.

An account of the results of an intensive treatment of a Wiltshire Down pasture has been published by L. G. G. Warne (Ref. 29).

The well-known effect of sulphate of ammonia in depressing the clover in a mixed sward or turf has been further studied by G. E. Blackman at Jealott's Hill. He traces the effect to the ammonia, which is directly harmful to the plant, and finds that the harmful effect is reduced by adding sucrose—an observation which bears on the physiological explanation of the phenomenon (Ref. 30).

Improvements in the Making of Field Experiments.

Considerable improvements have been made at Rothamsted during the past few years in the design of field experiments, and the new methods are considerably more efficient than the old. On the old plan a separate experiment was laid down for each factor investigated, and this factor alone was varied, all others being kept constant (if possible) at some arbitrary level. On the new method several factors are tested in each experiment. The design, of course, becomes more complex, but it has the advantage that each experimental unit is utilized to give infor-

mation on all the factors investigated, so that it is used several times over with, of course, a considerable gain in efficiency. More important still, the experiment shows how the effect of one factor is modified by variations in other factors (Ref. 31).

The principles underlying these new methods can be applied quite well to many other investigations besides field experiments. After many trials the Rothamsted workers have devised for fertilizer experiments a twenty-seven plot test embodying all combinations of nitrogen, phosphorus and potash in zero, single and double dressings. There is no replication in the ordinary sense, yet the effect of replication is obtained because there are nine plots with no nitrogen, nine with one dose, and nine with two doses of nitrogen; similarly for the other fertilizers. The plots are arranged in three blocks, each containing nine plots in random order, but so selected that three contain no nitrogen, three contain one dose, three contain two doses; but three also contain no phosphate, three contain one dose, and three contain two doses; and so again for potash. The arrangement is proving very useful; it can be worked quite well on ordinary farms, and a number of instances are given in the Rothamsted reports. It is being used in other countries as well as this; the Rothamsted staff have arranged a series of experiments of this kind on rubber plantations in Malaya.

The randomized block is of wider applicability than the Latin square, though it is not quite as accurate; the standard errors, expressed as percentage of the mean yield, of the two types of design have been in our experiments :—

Potatoes—	
Randomized blocks, 22 experiments	9·2
Latin squares, 56 experiments	6·8
Sugar Beet, Roots—	
Randomized blocks, 15 experiments	7·9
Latin squares, 28 experiments	6·1

The Interactions of Leguminous Plants and Non-leguminous Plants Growing With Them.

The fact that soil nitrates are detrimental to the nitrogen-fixing activities of the nodule organisms leads one to expect that leguminous plants will grow better in the presence of non-leguminous plants than when grown alone. There is some evidence for this, at any rate so far as power to persist in the soil is concerned. Lawes and Gilbert, at Rothamsted, made many attempts to grow clover, tares, beans and other leguminous crops continuously on the same land for a number of years; but they failed, excepting only on a rich garden soil. Non-leguminous crops, on the other hand, could be grown continuously for many years without undue difficulty. But in the natural grass fields where clover grows intermingled with grass it persists year after year and shows no sign of failure.

It is not yet clear how this comes about; the problem needs further investigation.

The effect of leguminous upon non-leguminous plants growing along with them has, however, been studied rather more fully. The evidence has recently been summarized by H. Nicol (Ref. 32). The early experiments of J. G. Lipman and of Lyon and Bizzell showed that a non-leguminous crop such as oats, grown in pots along with a leguminous one (field peas, etc.) made better growth than when there was no leguminous crop growing. It was assumed that the leguminous plant must somehow have furnished nitrogen compounds to its neighbours, but the process was not at all clear. Virtanen, in Finland, has recently re-examined the whole subject and obtained some exceedingly interesting results. He showed that leguminous plants grown in sterile sand, but inoculated with the proper organism, excreted from their roots marked quantities of soluble nitrogen compounds, which seemed to be mostly amino-acids with small quantities of basic nitrogen compounds, not, however, free ammonia (Ref. 33). Non-leguminous plants growing along with the leguminous ones can take up this nitrogen and make use of it for their growth. Alders, although not leguminous plants, have on their roots nodules containing nitrogen-fixing bacteria; these also excrete nitrogen compounds into the soil.

Various efforts have been made to find out how much nitrogen is excreted in this way. Some of Virtanen's experiments suggest that there may be as much nitrogen excreted as is retained in the plants. Other experiments have been made to find out how many non-leguminous plants could be put on to one leguminous plant as, so to speak, their foster mother. Virtanen mixed oats and peas and obtained the best results when there were about two oat plants to one pea plant; when the oats were more numerous the peas suffered from competition; they were dwarfed, and excreted less nitrogen so that the oats in turn suffered.

H. G. Thornton and Nicol, at Rothamsted (Ref. 34), have confirmed the general result. Italian ryegrass grown in admixture with lucerne, but without nitrogenous fertilizer, contained 2½ times as much nitrogen as grass similarly grown by itself without lucerne. When a little nitrate of soda was added the difference was even more marked, and after eighteen weeks the grass grown with lucerne contained nearly six times as much nitrogen as that grown alone. When larger amounts of nitrate of soda were given, however, the benefit due to the lucerne fell off, because of the adverse effect of nitrate of soda on the activities of the nodule organism, and because the lucerne itself suffered in competition with the grass.

These experiments were all made in sand. They show what processes are at work but they do not necessarily show what would happen in the soil, because soil organisms and other factors introduce further complications. Agricultural experimenters know that it is never safe to argue from sand culture to field practice. Some field experiments have already been made in 1932 at Rothamsted. Oats were grown alone, and vetches were grown alone; they were also grown together in different proportions; a basal dressing of potash and phosphate was given to all the plots; half of them received sulphate of ammonia, the other half did not. The total amount of crop was larger for the mixtures than for either of the single crops. Also the percentage of nitrogen in the oats was larger when vetches were present than when they were absent. All this looks like agreement with the pot experiments. But when the results are examined in detail they afford no evidence of any beneficial effect of the vetches on the oats. On the contrary the yield of oats was reduced by the vetches and the yield of vetches reduced by the oats. The nitrogen percentage in the oats was certainly larger in presence of vetches than in their absence but the total quantity of nitrogen they contained was less; and it is the total quantity of nitrogen, not the percentage of nitrogen, that indicates the amount that had been available to the crop. There was no evidence that any nitrogenous excretions from the vetches proved beneficial to the oats. The two crops were able to grow together, each more or less ignoring the other so that we obtained two crops at the same time on the one piece of land. But they had actually competed and neither grew quite as well in the mixture as it did alone. The results were (Ref. 35):—

	4 Oats. 0 Vetches.	3 Oats. 1 Vetches.	2 Oats. 2 Vetches.	1 Oats. 3 Vetches.	0 Oats. 4 Vetches.
Dry matter, cwt. per acre.					
Oats—					
Without Nitrogen	42·9	36·6	30·5	21·7	—
With Nitrogen	53·5	44·4	41·0	26·0	—
Vetches—					
Without Nitrogen	—	11·0	18·4	23·9	28·6
With Nitrogen	—	8·6	14·9	19·1	30·9
Total Dry Matter—					
Without Nitrogen	42·9	47·6	48·9	45·6	28·6
With Nitrogen	53·5	53·1	55·8	45·2	30·9
Nitrogen per cent.					
Oats—					
Without Nitrogen	1·145	1·329	1·287	1·401	—
With Nitrogen	1·158	1·197	1·247	1·361	—
Vetches—					
Without Nitrogen	—	2·702	2·725	2·865	3·061
With Nitrogen	—	2·659	2·761	2·908	2·993

The higher nitrogen percentage in the oat crop in presence of vetches is better evidence of a depressing than of a beneficial effect of the vetches. The oats, like other non-leguminous plants, take up most of their nitrogen in the first few weeks of their growth. Favourable conditions enable them to use it advantageously and to produce large quantities of carbohydrate for each unit of nitrogen assimilated by the roots; the crop is therefore large, but the nitrogen percentage is then relatively low. Unfavourable conditions, however, prevent their making full use of the nitrogen, and so a smaller crop is produced with, of course, a higher percentage of nitrogen. The argument of some of the older investigators that the higher percentage of nitrogen in the non-leguminous crop indicated a beneficial effect of the leguminous crop is unsound; it is only an increase in the total quantity of nitrogen in the crop that would prove this.

Other field experiments have given the same result. In 1931 barley was grown by itself and also in admixture with clover; with clover and ryegrass; and with ryegrass alone. As in the above experiment, half the plots were treated with sulphate of ammonia and half were left without added nitrogen. There was no benefit to the barley from the mixture of clover except on one set of plots, and it is doubtful whether this was significant; the experiment needs repetition. The barley, however, showed no signs of suffering from the competition of the clover and the gain per acre of land was, as before, considerable.

EFFECT OF UNDERSOWING (Ref. 36). (Rothamsted, 1931).

	No under sowing.	Undersowing with		
		Clover.	Rye-grass.	Clover and rye-grass.
Yield, bushels of grain per acre—				
Sulphate of Ammonia . .	32·6	37·2	32·2	33·4
No Manure	31·6	32·0	31·0	30·8
Per cent. of Nitrogen in grain—				
Sulphate of Ammonia . .	1·70	1·72	1·68	1·68
No Manure	1·72	1·72	1·70	1·71

The older Danish experiments (Ref. 37) had given the same results. In these experiments spring oats were undersown with Italian red clover and with serradella. There was no benefit, but on the other hand no harm was done; the average results were, in kilograms of oats per hectare:—

Mean yields.	Grown alone.	Undersown with	
		Seradella.	Red clover.
1910–1916	1,004	1,052	1,062

Stallings (Ref. 38), in 1926, had apparently obtained the same result; he grew mixtures of soya beans and wheat, and his tables suggest that both yield and total nitrogen content were depressed by the admixture.

There is therefore an apparent discrepancy between the pot experiments and the field results, which, however, is quite consistent with the possibility that both are right. Nitrogenous excretions from the roots of leguminous plants may occur in natural soils, but the non-leguminous plants under field conditions may be unable to utilize them. The question needs more attention from experimenters.

From the practical point of view the important result is that the power of the two crops to grow together has more than counterbalanced the depressing effect of the competition between them. If one wanted oats they are best grown alone, or if one wanted vetches; but if the need is for fodder then the mixture may be better—it certainly gives more bulk, though the amount of protein per ton is less than in the vetch crop alone. In other words, the gain is largely in the starch equivalent. This possibility of mixing crops deserves further investigation; some of the mixtures tried at Rothamsted in the old days (*e.g.*, oats and barley) showed no advantage over the separate crops. On the other hand, West Country farmers frequently prefer the mixture. It may be that there is greater safety in sowing two crops than in sowing one, and this would be an advantage even if there were no other gain. Nicol has collected instances showing that mixed cropping is a frequent practice in primitive agriculture (Ref. 39). The safety factor here is of obvious importance.

The growing plant also affects the soil in other ways: Wallace has shown that grass, when grown as a cover crop, raises the potash- and the iron-content of the soil water; iron deficiency in fruit trees is often cured by "grassing down." Potash deficiency in trees has also been noted to be often decreased by "grassing," and this has been explained previously as due to reducing the nitrogen: potash ratio. The part played by the increase in soluble potash, however, requires examination (Ref. 40). He thus explains the paradoxical result that clean culture of fruit is not always the best; weeds in the orchard have their uses.

The nodule organism : Inoculation of leguminous crops.

For some years past H. G. Thornton, at Rothamsted, has been occupied with the problem of inoculating lucerne seed with the necessary bacteria to ensure good growth of the crop. A simple process has been devised, and Messrs. Allen & Hanburys put up the cultures in a convenient form for use on the farm. The process is so well known and the benefits so marked that farmers now regularly treat their seed before sowing.

Dr. Thornton is now occupied with the search for more efficient strains of organisms in the hope of still further improving the process ; a slow and tedious business. During the course of the work he found a strain of the clover organism remarkable for its inefficiency. It occurs on the Welsh hills ; having seen how little the organism is capable of helping the clover plant one can easily understand why clover should so often be difficult to establish in Welsh hill pastures. In one of Dr. Thornton's experiments, alsike clover was grown in three sets of pots all of which were inoculated with the local Rothamsted strain of the organism ; one had nothing else ; another was inoculated in addition with specially selected clover strain called " A " ; while the third was inoculated with the Welsh strain. The two first sets grew well, the third did not. After some weeks the plants were analysed to find how much nitrogen the various strains had fixed ; the quantities were, in milligrams per pot :—

Local Rothamsted strain.

Alone.	Plus selected strain " A."	Plus Welsh strain.
275	318	34

It thus appears that the Welsh strain was not only bad in itself but that it prevented the useful local strain from acting. The specially selected strain " A," however, was more potent than the local strain, and helped considerably to overcome the bad effect of the Welsh strain ; when it was added to the pots the results were :—

Local strain.		Welsh strain.	
Alone.	With strain " A."	Alone.	With Strain " A."
275	318	34	112

It is possible that the Welsh strain is widespread in hill districts and ought really to be called the Hill strain, for it is not uncommon for clover to do badly in hilly countries. The difficulties of searching for it are increased by the fact that all the strains look alike under the microscope (doubtless because the

organisms are so small that minute differences between them escape our eyes) and the only certain way of distinguishing the strains is to try their effects on the clover plant, a slow process. However, the work is so important that it is being pushed on as quickly as possible (Ref. 41).

Antagonism between soil organisms.

These observations by Dr. Thornton show that there may be antagonisms between one kind of soil organism and another. Two other antagonisms are being studied at Rothamsted: the antagonism between soil bacteria and soil protozoa and the antagonism between certain soil actinomycetes. These last-named organisms include a number of forms that cause disease. G. Samuel has shown that certain races will not intermingle; when they are grown on the same culture plate each will develop till it comes near to the other, but then it is stopped short as if by a toxic secretion. This suggests interesting possibilities in the way of controlling soil fungi that cause plant diseases (Ref. 42).

Soil sterilization: Partial sterilization.

The safest means of getting rid of undesirable soil organisms is, of course, to kill them, and this can often be done by some sterilization method. Experiments were begun at Rothamsted on this subject nearly thirty years ago and the results were so satisfactory that the process was taken up by nurserymen and growers under glass, who have gradually improved and cheapened the methods until soil sterilization has now become a standard part of glasshouse practice. The older methods commonly involved blowing steam through the soil from spikes or grids, or blowing it under trays inverted on the soil; the heat then travelled downwards. These methods were quite good, but they did not always ensure that all the soil had been heated, and pockets of the pests or harmful organisms might survive and, later on, spread into the sterilized soil. New and improved methods have overcome this difficulty; one of the latest, the "Hoddesdon pipe system" devised by Mr. J. Harnett, of Hoddesdon, has recently been described (Ref. 43).

The search for chemical sterilizing agents still continues, and interest has been recently revived in some of the older substances, the chlor- and the chlornitro-benzenes, chlorpicrin and others. Some of these are being tested as soil insecticides; there is great need for further work on this subject.

The Soil and its Properties.

Ever since the War there has been a vast amount of time and money expended in practically all civilized countries in making investigations on the soil, and the work is co-ordinated

and the workers kept in touch with each other through the activities of the International Society of Soil Science, which includes practically all the soil investigators of the world.[1] A great mass of knowledge has accumulated about the structure and composition of the soil and its relation to the growing plant, It cannot be claimed that these scientific discoveries have resulted in striking practical achievements comparable with the discovery of artificial fertilizers 100 years ago. Nevertheless the aggregate effect has been to give to agricultural experts definite knowledge about the soil which they never had before, and as the result of which their recommendations are more precise and more trustworthy than in the past. In most civilized countries, certainly in our own, the recent agricultural crisis has been the worst in history; yet the effect on farmers here was much less than in some of the crises of the 19th century, when soil science was less developed. There is little doubt that the steady development of soil science has been an important factor in helping farmers to mitigate the bad effects of the recent disturbed economic conditions.

Soil Mapping.

One of the striking services that soil science has rendered in recent years has been in surveying the soils of the different countries and in the preparation of maps on which any desired part of the information can be represented. This is now recognized as an essential preliminary to all agricultural developments, reclamations and irrigation schemes; and it forms an integral part of any organized development of agriculture such as is now being carried out in many of the countries of the world. To start any important agricultural development without a preliminary soil survey is to run serious risk of disaster, and it should never be done.

Two groups of soil surveys have been made. The general survey aims at recording the major soil types and showing how their distribution is related to the climatic, geological, topographical, vegetation and other conditions over the area concerned. A soil map of Europe has been constructed during the last twenty years by Prof. Stremme, of Danzig, with the collaboration of many soil workers in different countries. An elaborate series of maps of the soil zones of Russia is being built up under the supervision of Profs. Polynov, Prassolov and their colleagues of the Dokuchaiev Institute, Moscow (formerly Leningrad), and a soil map of Australia has been prepared by Prof. Prescott. These surveys are of great scientific interest in providing data for the study of soil morphology, and they are of practical value in showing the regions within which particular

[1] The Headquarters of the British Empire Section are at Rothamsted.

kinds of soil may be expected. In these maps the classification is based on the soil properties, not on the geological formation. Both climatic and geological factors determine the properties of the soil and neither group of factors by itself would suffice as a basis of classification when working over very large areas.

For the purposes of the practical farmer the scale of these maps is, however, too small. Much more detailed surveys are needed for agricultural advisory purposes and these have been going on in this country for the past forty years. In the earlier ones by Hall and Russell of Kent, Surrey and Sussex, and by C. M. Luxmore of Dorset, the soils were grouped according to geological origin, with sub-divisions based on mechanical analysis. This basis was inadequate for the older geological formations, and the later surveys have more usually been based on soil properties, particularly on those of the soil profile. Unfortunately the surveys have not been adequately published and the results are therefore not generally available, so that much valuable work lies hidden. Advantage was taken of the recent visit of the members of the International Society of Soil Science to publish accounts of the soils of the regions through which they passed in the course of their excursion round the British Isles, and the following have been issued in the Empire Journal of Experimental Agriculture :—

Scotland, W. G. Ogg (Ref. 44).
Yorkshire, H. G. Trefor Jones (Ref. 45).
E. Anglia, H. H. Nicholson and F. Hanley (Ref. 46).
Wales, G. W. Robinson (Ref. 47).
Shropshire, W. Morley Davies and G. Owen (Ref. 48).

These have been bound together into one volume. It is to be hoped that this publication may either develop into, or else call forth, an adequate account of the soils of Great Britain.

Meanwhile the Land Utilization Survey of Britain is proceeding and a number of maps have already been published (Ref. 49).

Soil tilth : Building up the soil crumbs.

One of the chief purposes of soil cultivation is to build up the soil particles into crumbs of the best size for plant growth. Good farmers in various parts of the world have discovered empirically how to do this, and scientific workers are trying to understand the mechanism of the process. Crumb formation is being studied in the Soil Physics Department at Rothamsted. It is shown to depend on the clay and on the wetting liquid—some liquids will form crumbs and others will not ; water is one of the best and petrol one of the worst. The relations between the chemical and physical properties of the clay and its power to

form crumbs has been investigated by E. W. Russell (Ref. 50), and a hypothesis has been put forward to link up and explain the observed facts. The actual making of the tilth is done by the weather; what the farmer must do is to choose the operations that are right for the weather at the time he is working.

The chief water supply for the growing plant is what is held in the capillary pores of the crumbs; the amount of this capillary space, therefore, determines the amount of water the soil can hold for the plant. The spaces between the crumbs (interspaces), on the other hand, form the channels down which excess of water can drain away and through which air can circulate to the plant roots. In wet regions it is obviously desirable that the interspaces should form a considerable part of the total pore-space; in dry regions, on the other hand, the capillary pore-space of the crumbs should form a larger proportion. Recent measurements in Russia by Dojarenko show that, in the wet region around Moscow, the interspaces should form about 50 per cent of the total, the capillary pores forming the other 50 per cent; while in the hotter, drier region of Samara, Kvasnikov showed that the interspaces should form only about 25 to 35 per cent. of the total, the remaining 65–75 per cent. being capillaries (Ref. 51).

The breaking down of the crumbs: Soil erosion.

When the crumbs break down the soil in a wet region becomes a sticky slime, difficult to cultivate. In a dry region it becomes a dust that may easily blow away. This is very liable to happen where the land has been cultivated for a certain number of years, particularly where, as often happens, there has been a fallow every second or third year. The organic matter that helped to bind the crumbs becomes oxidized; already about one third of it has disappeared from some of the Canadian and United States soils, and this may involve not only the loss of nitrogen but, what is far worse, may lead to the loss of the entire soil. The soil aggregates are broken down to a fine dust which readily blows about, causing the dust storms that are so annoying to the traveller. The surface soil, including the young crops, may be completely carried away. In the United States some 11 million acres have been abandoned because of soil erosion; so serious is the loss that special experimental stations are set up to deal with it, and a colossal wind break, 1,000 miles long and 100 miles wide, is to be planted in the next ten years from the Canadian border to the Texas Panhandle at an estimated cost of 75 million dollars. Western Canada and parts of Africa have suffered severely. In Queensland actual erosion has been less serious, but the deterioration in physical condition has been very marked, and the nitrate that accumulated during the

decomposition was harmful because there was too much of it, and the cotton grew rankly and fruited badly (Ref. 52). The problem in Kenya has recently been discussed by V. A. Beckley (Ref. 53).

SOIL WATER RELATIONSHIPS.

The water relationships of the soil have been, perhaps, more fully studied than any other soil factors concerned with plant growth, and the vast accumulation of knowledge is now being put into definite order. The general divisions by "wilting points" and "moisture equivalents," introduced in 1897 by Lyman Briggs and later associated with McLane and Shantz, have stood the test of time, and still remain the best of the measures that we have. The "wilting point," as its name implies, represents the percentage of moisture left in a soil when plants just begin to wilt; it is the amount of water held too firmly to be extracted by the plant. The "field capacity," approximately measured by the "moisture equivalent," apparently represents, for many soils, the largest amount of water that a well-drained soil can hold; whatever can drain away has gone, but this balance will remain until it either evaporates or is taken by the plant. These amounts vary greatly in different soils; some of the results obtained by Botelho da Costa and R. K. Schofield at Rothamsted (Ref. 54) are as follows:—

MOISTURE CONTENTS OF TYPICAL SOILS AT THE DIFFERENT STAGES OF DRYING OUT.

(R. K. Schofield and J. V. Botelho da Costa.)

Soil.	Just too dry for plant growth.		Properly moist.	
	Wilting Coefficient (plants wilt).	The new pF scale.	Moisture equivalent.	The new pF scale.
Sandy	2·88	4·02	11·51	2·70
Chalky	3·09	4·24	24·28	2·70
Sandy organic	3·67	4·16	12·16	2·69
Loam	4·60	4·35	15·11	2·51
Heavy loam	13·37	4·40	29·30	2·94
Clay	21·55	4·09	31·40	2·96

These figures show the difficulty of interpreting the meaning, so far as the plant is concerned, of the percentages of moisture in the soil. For example, a moisture content of 20 per cent. would mean, for soil No. 1, complete waterlogging and asphyxiated plant roots. For soil No. 2 it would mean a very favourable condition for growth. On soil Nos. 5 and 6, however, the plants would have wilted and probably died before the drying had got so far. This trouble looks like being finally overcome by the ingenious method devised by R. K. Schofield of measuring

the water, not by its actual quantity, but by the hold which the soil has upon it; he uses a logarithmic scale called the pF, analogous to the well known pH or soil acidity, so that he can express the water content from the point of view of plant growth, which of course is the important thing (Ref. 55).

Water movements in the soil.

In recent years there have been great changes in our ideas of the mechanism of water movements in soil; the older conception of capillary films, which figured so much in the literature thirty years ago, has been abandoned by soil experts. On this older idea water added to a soil was supposed to spread itself almost uniformly over the whole body of soil so long as the particles were in actual contact, and any thinning of the capillary film in one part of the soil caused an immediate transfer of water from the moister parts. In like manner the addition of water, either from rain or irrigation, affected the whole mass by thickening all the films. This is now known to be incorrect; upward capillary movement of the sort that used to be demonstrated in long glass tubes filled with soil and stood into dishes of water is now recognized as quite unimportant, for reasons set out by W. B. Haines at Rothamsted and by Buckingham in the United States. Shaw, Veihmeyer and others working in California have shown experimentally that added water moistens just so much of the soil as it can fill up to the "field capacity," and that any further movement after this is very slow. A sharp boundary remains for some time between the part of the soil so moistened and the adjacent parts which remain dry. Water may still be transferred by evaporation and condensation, as shown by Lebedeff, and in some cases this may be an important supply of moisture. There is, however, no important transfer by capillarity. In dry regions the moisture in the soil at a depth of 8 in. is almost unaffected by the evaporation that takes place at the surface, and by the shallow cultivations made to conserve the soil moisture. Fruit trees (peaches and prunes) may draw their water supply from the top 6 ft. of soil but not more; they wilt if this top layer is dry no matter how much water there may be lower down. Trees can utilize with almost equal ease all the water between the "field capacity" (practically the same as the "moisture equivalent") and the wilting point; the ideal course therefore is to moisten the soil to its "field capacity" and to the depth penetrated by the roots, but no deeper (Ref. 56). This discovery has proved of great importance, and in Viehmeyer's hands has revolutionized irrigation practice in California, and looks like solving that most difficult problem in all irrigation schemes: how much water should be given to the cultivator to ensure the

best results? Knowing the percentage of water actually present in the soil and the depths of the plant roots, it is easy to calculate the quantity of water per acre that must be added to raise the water content up to the moisture equivalent of the soil which has been determined once for all by the soil survey. Water can be added in excess of this quantity if salts are present in the soil so as to wash them down; in some cases the salts have even been driven 25 ft. below the surface (Ref. 57). The Californian water engineers have systematized and organized the work admirably, and they have been able to effect great economies in the use of water and to avoid spoiling of much good land by the application of excess water.

It might be asked: What is the practical use of knowing how the water moves in the soil? What does it matter whether the old theory of capillarity was right or wrong? The answer is that new practices such as water supply for irrigation are very much influenced by current teaching of agricultural science and that if this is ill-founded the practical recommendations suffer. It is only since the modern ideas of soil moisture relationships have been developed that sound control of irrigation practice has become possible.

Another example of the need for the sounder knowledge is afforded by the so-called "dry farming" practice. So long as it was held that water moved in the soil by capillarity it was obviously right to recommend farmers in dry countries to fallow, and to keep on cultivating the fallows so as to break the capillary tubes at the surface and maintain a fine surface mulch that would prevent them reforming. Frequent disking and the production of a dust mulch were confidently recommended, and were considered the best practice. Now that the ideas on capillary movement are so radically altered it is recognized that this recommendation was wrong. A mulch is very desirable, and a straw or dead vegetation mulch would be one of the best; weeds must be rigidly kept down, but apart from this no cultivation appears to be necessary, and the formation of a dust tilth is now known to be positively harmful.

The other problem of dealing with the removal of free water which might be harmful is very important on heavy clay soils where drainage is necessary, and farmers ask advice as to the proper depth and distance apart of the drains. On the old idea of free capillary and intercapillary movement the water table would be expected to sink uniformly and continuously on drainage, and some pleasing mathematical formulæ were set up to give the necessary distances between the drains. Recent experimental work, however, indicates that the fundamental assumption is wrong; the water does not soak away uniformly and continuously. These heavy soils have the curious

property of splintering on drying into blocks of characteristic but irregular shapes and of various sizes, separated by cracks varying from visible to invisible dimensions. It is almost certainly down these cracks, and not through the pores, that the water drains away (Ref. 58); and in passing it often deposits organic matter and oxides of iron and manganese which give a darker colour to the surfaces of the cracks. Experimental drainage fields have now been set up in Prussia, Poland, Finland and elsewhere, and these may be expected to furnish material for a better treatment of the drainage problems than exists at present.

How much Plant Food does the Soil Contain?

When the Bath and West Agricultural Society set up the first agricultural chemical laboratory in this country in 1806, and appointed a chemist to analyse farm soils and advise about their management, it put to chemists a problem that they are still trying to solve: How much plant food does this sample of soil contain? The difficulty is not only with the soil but with the plant; different plants have different requirements, and even the requirements of a given plant are not constant but vary with the water supply, the climatic and other environmental factors. In one season a soil may respond to phosphatic manuring, in another it may not. Further, the value of the plant food depends very much on the time when it becomes available to the plant; late supplies are much less useful than early ones. A considerable number of methods have been devised, but all of them have some weaknesses. In recent years an organized international investigation has been made by members of the International Society of Soil Science and the results have been collected by Prof. Mitscherlich. Further work is being done and discussion is therefore postponed (Ref. 59).

Mechanized Grain Farming.

The problems of mechanized grain farming are being investigated at several centres, notably at the Oxford Institution of Research in Agricultural Engineering and at Rothamsted. The relative costs of cultivation by horses, by small tractors and by large ones are illustrated by the following figures of costs of ploughing drawn up by J. R. Lee (Ref. 60):—

	2-horse team.	Light tractor.	Large tractor.
	s. d.	*s. d.*	*s. d.*
Cost per hour	1 4	3 0½	6 6
Acres ploughed per day of 9 hours	1	3	11
	s. d.	*s. d.*	*s. d.*
Cost of ploughing per acre	12 0	9 1½	5 2

The large tractor does the work at little more than half the cost of the small one, thus giving a great advantage to the large scale operator.

The next important point is this: How long can wheat be grown successfully on the same land? Both at Rothamsted and at Woburn continuous wheat cultivation has proceeded for many years and, apart from the difficulty of keeping the land clean, there has been no special trouble in obtaining crops of wheat. The 92nd successive crop was grown this year (1935) on Broadbalk and the manured plots are quite reasonably good. At Woburn the crop has not continued so well, but the manuring is on a lower scale. No special difficulty about disease was observed for many years, but more recent observations show some soil fungus trouble, *e.g.*, "take-all" and foot-rots. The soil conditions are :—
At Rothamsted—Heavy soil which easily compacts: neutral.
At Woburn—Light soil, does not easily compact: slightly acid.
Neither of these soils, however, quite represent the conditions on the chalk soils where mechanization is now being practised :—
Chalk soil—light, does not easily compact: slightly alkaline.
So far as the wheat plant is concerned there is no obvious reason why it should not continue to grow on these soils for many years in succession; but the position in regard to diseases and pests is quite different from that at either Woburn or Rothamsted. The slight alkalinity and the lightness of the soils are favourable to the root fungus "take-all" (*Ophiobolus graminis* Sacc.), which certainly occurs at Rothamsted but never does much harm, while it is serious in some parts of the country. Other pests may also survive readily on these light alkaline soils. For this reason a second wheat crop should not be taken if a pest likely to give trouble has already appeared. Fortunately "take-all" does not persist long in the soil; a change to another crop, *e.g.*, oats, on suspected land is probably the best way of dealing with it. Other pests will similarly need watching. The more one sees of the agriculture of chalk soils the more one admires the old sheep-folded rotations which allowed a fairly wide interval between successive crops and ensured the compacting of the ground by sheep.

Fallowing.

At Rothamsted fallowing during summer and autumn has been the best preparation for the wheat crop, being superior to clover or seeds ley—though economically less advantageous when the hay is of sufficient value. Its advantages are that it enables the weeds to be killed, it increases the store of water and of nitrate in the soil, and it brings the soil into a good tilth. There may be other advantages as well, for the increased yield immediately after the fallow is very marked.

The result is demonstrated on the Broadbalk wheat field where, since 1930, one-fifth of the field has been fallowed each year and then cropped for four years before re-fallowing. The yields are as follows, in bushels of wheat per acre.[1]

	No Manure. Plot 3.	Mineral manures only: no nitrogen. Plot 5.	Complete artificials manure. Plot 9.	Farmyard manure. Plot 2.
After fallow . . .	28	27	31	28
After crop . . .	11	9	22	24
Benefit from Fallow .	17	18	9	4
Percentage increase .	155	200	41	17

The effect is more marked on land poor in nitrogen than on land well supplied with it; this suggests that part of the benefit of the fallow is to be attributed to the nitrate accumulated in the soil. To get the best results from the fallow the land must be sufficiently cultivated to ensure that weeds are kept down. It would be interesting to know if there is any advantage in doing more than that; and whether, so long as weeds are killed, there is need for further cultivation. Could the full beneficial results be obtained by chemical destruction of the weeds without cultivation? (Ref. 61). Fallowing seems to be beneficial both in wet and in dry conditions, but much of its advantage is lost if a wet winter intervenes between the fallow and the sowing. Apart from the suppression of weeds there is no evidence that the advantage of fallowing extends into a third or fourth year.

This is a question of practical importance in some parts of England where fallowing or pen fallowing is prescribed by the terms of the lease, and the question arises: What dilapidations should a farmer be called upon to pay on quitting his holdings if he has not given the fallow at the proper time? The question is one for experiment in the districts concerned, but on present evidence it would be difficult to prove dilapidations after the first crop, provided the land is kept reasonably clean.

Deep cultivation and subsoiling.

The advantages of deep cultivation are well understood and it is widely recognized that the subsoil should remain in its place below the surface soil and should not be brought up to the top. A new implement, the Gyrotiller, is being used in the dry Eastern counties of England for cultivating the soil to a considerable depth. Like the subsoiler, it keeps the surface soil on the surface, so that there is no detrimental action to set against the beneficial effect of the deep cultivations. It is not

[1] 1 bushel per acre = 0·9 hectolitres per ha.

generally recognized how far roots will penetrate into the soil. In 1934 measurements were taken of the root growth of sugar beet on the sandy soil at Woburn and roots were found at 5 ft. depth during the course of a single season. It was a dry year and the plants were able to obtain moisture from all this quantity of soil. Had there been a compact layer of soil they probably could not have done so and the yield would have suffered.

There is a steady growth of experience with subsoiling, and the general conclusion to which one is led after examining the results is that, while it is excellent in some conditions it has not always been worth doing. In consequence it should not be undertaken on a large scale without careful experiments to see whether the expense is justified. There are many soils on which it gives no adequate return and on which therefore it should not be practised ; at Rothamsted it has hardly given results sufficient to justify the cost. In hot, dry countries deep cultivation is frequently unnecessary or even harmful, shallow surface cultivation being all that is needed. Experiments are always necessary to discover what the action will be ; there is no way of estimating it beforehand.

Substitutes for farmyard manure.

Of all the soil questions raised by mechanical farming none is more important than this one. The difficulty of giving an answer lies in the fact that mixtures of artificials are easily devised that will be as good as farmyard manure for the first five years or more, and no experiment lasting less than ten or fifteen years can be expected to give any definite answer as to what happens afterwards. We know from the Rothamsted and Woburn experiments that after a time farmyard manure is superior to artificials alone, and we assume that the straw must be returned to the land.

Experiments on this subject have been going on for the past five years at Rothamsted and the results of the first rotation are now issued (Ref. 62). Straw was returned to the land in the following ways : (1) as farmyard manure ; (2) rotted in a heap to make artificial farmyard manure ; and (3) ploughed direct into the soil with the addition of the proper artificials to ensure its rotting down properly. For comparison there were two sets of artificials ; one containing the phosphate as super, the other containing it as ground mineral phosphate. Equal amounts of plant food per acre were given in all cases, and in each year all crops of the rotation were grown ; each crop received also all the manurial treatments. The yields per acre of the whole rotations including the residual effects during the period have been as follows :—

	Straw returned to soil.				No straw returned : Artificials only.		
	As farmyard manure.	Rotted as artificial farmyard manure.	Ploughed straight in, but artificials added.	Mean of straw manures.	Phosphate as super.	Phosphate as mineral.	Mean without straw.
Wheat grain, cwt.	25·5	25·0	25·6	25·4	25·4	24·7	25·0
Barley grain, cwt.	24·3	23·5	26·3	24·7	26·1	22·5	24·3
Potatoes, tons	3·61	2·98	3·82	3·47	4·61	3·54	4·08
Hay dry matter, cwt.	11·6	10·5	8·3	10·1	15·2	14·1	14·6

For this first four years the artificials with superphosphates have been as good as the dung for the wheat and barley, and distinctly better for the hay. The yield of potatoes was low, much less than usual on the farm. How long the artificials will continue equal to the farmyard manure remains to be seen; they were equally effective for a long time on Broadbalk and on Hoos fields, but afterwards they began to fall off in value. Mineral phosphate did not act as well as superphosphate.

Of the various straw manures, the one in which straw is given a dressing of artificials to rot it and then ploughed straight into the soil has proved as good as any except on the hay crop, for which, of course, it could not be ploughed in and so had to be given as top dressing; in some seasons this interfered with the proper growth.

The residual effect cannot be discussed in detail till more rotations have passed, but the average results have been :—

	Year of application.	Residual years.			
		First.	Second.	Third.	Fourth.
Farmyard manure .	130	99	92	89	86
Straw . . .	107	92	85	98	90
Straw + artificials .	119	90	104	96	109

(100 = mean of all the straw and the farmyard manure results.)

In the first year the farmyard manure was more effective than any treatment, especially on the potato crop, but more results would be needed before much can be said about this. The present position is that the problem of returning the straw to the land does not appear to be insoluble, and the method adopted in this experiment may prove a satisfactory basis for a sound practical procedure.

Straw and horticultural soils.

A method of using straw in glasshouse soils is being tried at the Cheshunt Experimental Station and adopted by glasshouse growers in the Lea Valley. The object is to use the straw for promoting the aeration of the soil, always a difficulty under glasshouse conditions where much water is applied. When the soil is dug trussed straw is placed vertically in both the top and second spits, so as to make a wall of straw about 2 in. thick and 20 in. deep between blocks of soil 10 in. thick. About 6 tons of straw per acre is needed. The straw must be thoroughly soaked with water before the tomato plants are set out. Considerable improvement in the yield of tomatoes is recorded, especially on heavy land that has been liberally manured for a number of years; the method is not always so successful on light soil (Ref. 63).

Artificial Farmyard Manure from Straw.

In addition to the Rothamsted work on artificial farmyard manure made from straw a considerable amount of work is done in France, as was mentioned in the last report. This has now been summarized in a monograph published by the French Ministry. It falls into three sections, dealing respectively with the method of making and using the manure; its use in mushroom cultivation, a very important industry in France; and its use for making the hot beds used for forcing early vegetables (Ref. 64).

Composts.

A correspondent has pointed out an inaccuracy in the paragraph on this subject in last year's Guide and I therefore append a fuller statement.

The conversion of vegetable wastes into organic manures by composting is a very ancient process which has now been put on to a scientific basis. The fundamental principle is that sufficient nitrogen and phosphate must be present to enable the micro-organisms to do their work; if these substances are not contained in the material in the requisite amount they must be added

In the "Adco" process, the first of the scientific methods, these substances are added as simple salts, the quantities being adjusted to the nature of the material.

Instead of using added salts the nitrogen can be supplied from night soil, sewage and other household wastes. This has been done by Gilbert J. Fowler in Madras, and by Jackson and others at Indcre (Ref. 65).

In another process described by Auton in 1923 (Ref. 66) and used by him for making hundreds of tons of good manure at Pyrford Court, Woking, and in that used by A. Howard

and Wad at Indore (Ref. 67), no addition either of salts or of household waste is made, but the necessary amount of nitrogen is ensured by mixing young and old waste vegetable material: the young material generally contains too much nitrogen and the old material contains too little, so that mixtures can be put up that give a satisfactory end product.

This has been much used in England and in India and it is, under F. Keith Jackson's direction, proving successful in Ceylon also.

Land Reclamation.

Warping.

An account of the improvement or reclamation of low-lying soil by warping is given by A. G. Ruston. While this method is not universally applicable it is very useful in cases where a tidal river carries silt which can be deposited on low-lying land in such a way that the water can be drained off (Ref. 68).

The drainage of the Pontine Marshes in Italy.—An official account of this remarkable area has now been published and deserves full study by agriculturists (Ref. 69). This great swamp was for more than 2,000 years a notorious pestilential waste ridden with malaria, and is now laid out in farmsteads with comfortable houses, good roads, and attractive cities. I was recently taken over the region by Prof. G. Tommasi, who has been in charge of the scientific work there. The work is carried out in the name of the ex-servicemen's organization: Opera Nazionale per e Combattenti.

The first stage was the drainage, which was begun in 1928. There was a good deal of forest (*Quercus suberifera*: *Q. robur*, and marsh shrubs) and some of the trees had value for charcoal burning or for railway sleepers. When the trees were cleared deep channels were dug to allow the escape of the water; this work was both difficult and unpleasant. But once accomplished a dry surface was obtained on which the Fowler tackle could plough the soil deeply. The surface soil is in many places sandy, but it was underlain at a depth of 8 to 16 ins. by clay which was brought up by the plough and found to be a valuable ameliorating agent. Much of the soil was acid; a survey was therefore made to discover how much lime must be added and the proper amount was given. Experimental plots of wheat and fodder crops were started; these showed a marked lack of phosphate in the soil and superphosphate was therefore added. The main purpose of this and similar reclamations is to produce enough wheat to make Italy self supporting. Simultaneously with the land reclamation there was much work on the breeding and selection of wheats suitable for the conditions; the breeding was undertaken by Prof. Strampelli and the selection by Prof.

Todaro. The result has been that suitable varieties of wheat were available by the time the farms were ready and they are now in common use by the Italian farmers. They are mostly of the durum type, *i.e.*, the wheat used for making macaroni. One of the difficulties of wheat cultivation in this region is that when autumn sown it suffers from the winter rainfall, while if sown in spring it is caught either by April frost or by May and June drought according as the sowing is early or late. A like difficulty of timing affects the use of nitrogenous manure: this is in general a useful addition to the phosphate, but if it is put on too soon the plants develop too quickly and run the risk of damage by late frost, while if it is applied too late there is a considerable development of straw and little of grain, for the straw uses up so much soil moisture that little is left for grain formation.

Other difficulties arise from the highly dispersed nature of the clay—which has some of the properties of a sodium clay; and from the combustible nature of the marshy soils when they become dry, so that the farm sometimes catches fire.

All these various technical problems are being investigated. Meanwhile people are settled on the land, in comfortable houses, and with holdings of about 25 to 50 acres according to the fertility of the soil. I was informed that the cost of getting the land into order and building the house has been about £800–£1,000 per holding, in addition to the cost of drainage and road making. The chief products are wheat, followed by maize, fodder crops, potatoes, etc. But wheat production is the justification for the scheme, and in order to make it possible high prices have to be charged to the consumer and wheat from the world market has to be excluded by a high tariff. Further, the peasant has to work hard and to live very simply; macaroni or maize is his chief diet and meat is a rare luxury.

The spirit in which the work is done is illustrated by the opening words of the bulletin describing the soil: "The victory of wheat-growing attained in a mere eight years of toil has shown the Italians and the whole world how, even as regards the furtherance of agricultural production, which naturally has been regarded as slow and difficult, they can considerably accelerate the pace when, animated by profound and tenacious faith, they march united under the precise and infallible guidance of the Duce."

"This is a magnificent victory which has brought to Italy great and indestructible benefits not only economically but also from the spiritual and political point of view."

In going round this and similar reclamations it was clear that much of the work was done not as an economic proposition but "from the spiritual and political point of view."

These developments are among the largest in Europe, but they are by no means the only ones now proceding. The "Battle of the Wheat" has been fought and won in Portugal also; instead of importing wheat Portugal is now self-supporting, as France had earlier become.

The important question is, however, raised: What are these countries to do with the excess of wheat over their own requirements, which inevitably comes in a good year? It will be interesting to see how the problem is solved, but meanwhile the intervention of "spiritual and political" considerations in the agriculture of other countries makes it clear that our own agriculture should not be regarded solely from the economic point of view.

Tropical Agriculture.

The establishment in 1933 of the *Empire Journal of Experimental Agriculture* has provided a means for bringing together the results of agricultural experiments made on important subjects in different parts of the Empire; they can now be found in one volume instead of having to be sought through a vast number of different publications.

During the year accounts have been published of recent developments of experiments in the cultivation of rice in British Guiana (Ref. 70), in Ceylon (Ref. 71); cotton in the Gezira (Ref. 72); coffee in South India (Ref. 73); root system of coffee (Ref. 74); grassland in Kenya (Ref. 75) and in Australia (Ref. 76).

The black cotton soils of the Central Provinces, India, have also been described by D. V. Bal (Ref. 77).

General.

Great interest is being shown everywhere in the problems of plant growth and of agriculture, and several discussions or addresses of general interest have appeared during the year.

In the Thomas Hawksley lecture given before the Institute of Mechanical Engineers in October, 1934, and published separately, Sir Frederick Keeble (Ref. 78) describes in non-technical language the way in which the plant grows and builds up its substance.

Prof. R. Harcourt, of the Ontario Agricultural College, Guelph, gave an interesting account of the history of wheat in Canada, and a summary of modern problems in wheat production and milling and baking quality of flour, in his presidential address to the Association of Official Agricultural Chemists (Ref. 79) of North America.

Dr. J. G. Lipman, in "The Stuff of Life" (Ref. 80), discusses the broad question of the reserves of plant food in the soil and

the losses involved in our modern methods of managing our national life. He gives some very striking figures. In a lecture on the Future of British Farming delivered before the Royal Institution and published by them, the writer discusses some of the chief problems affecting crop production in this country (Ref. 81).

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CONTEMPORARY AGRICULTURAL LAW.

(*Note.*—This article covers a period of twelve months to the rising of Parliament and of the Courts for the Summer Vacation, 1935.)

I.—LEGISLATION.

I cannot take up my pen to write this article, at the request of the Editor, without some feelings of sorrow when I reflect that such request is occasioned by the death of my old friend, Mr. Aubrey J. Spencer, who was a gifted exponent of Agricultural Law.

During the period under review quite a number of statutes have been passed which agriculturists should not overlook.

The British Sugar (Subsidy) Act, 1935 (25 & 26 Geo. V., c. 37), extended by twelve months (*i.e.*, up to the 31st August, 1936) the period in which subsidy in respect of sugar is payable under the British Sugar (Subsidy) Act, 1925, and made further provision as to the rate of such subsidy payable. Section 3 (3) defined the references to a " week " or to a " fortnight " in the Principal Act as references respectively to a period of seven days and a period of fourteen days commencing on a Sunday.

The Cattle Industry (Emergency Provisions) Act, 1934 (25 Geo. V., c. 12), was noted on page 398 of the last volume of this Journal. By the Cattle Industry (Emergency Provisions) Act, 1935, provision was made for extending, by not more than six months, the period during which cattle or carcases of cattle must have been sold in order that payments in respect thereof might be made out of the Cattle Fund. It also authorized further advances to the said fund out of the Consolidated Fund of the United Kingdom. By the Cattle Industry (Emergency Provisions) (No. 2) Act, 1935, provision was made for further extending by not more than thirteen months the said period during which the said sales must have been effected in order that payments in respect thereof out of the Cattle Fund might be made. The proviso in Section 3 of the Act of 1934 as to marking of imported cattle was also varied.

The Unemployment Insurance Act, 1935 (25 Geo. V., c. 8) is an act to consolidate the Unemployment Insurance Acts, 1920 to 1934, and certain other enactments relating to those Acts. It came into operation on the 18th March, 1935, and contains 116 Sections and 7 Schedules. Part II of the First Schedule exempts from employments within the meaning of the Act employment in agriculture, including horticulture and forestry.

The Diseases of Animals Act, 1935 (25 & 26 Geo. V., c. 31). The object of this Act is to extend the Diseases of Animals Acts,

1894 to 1927, to Poultry with certain amendments and other provisions. It is an Act of three parts containing in all nineteen Sections and two Schedules.

Part I (*Sections* 1–10).

Section 1 provides for the general application of the said Diseases of Animals Acts to poultry. "Poultry" is defined as meaning domestic fowls, turkeys, geese, ducks, guinea fowls and pigeons.

"Disease" means, in relation to poultry, fowl pest in any of its forms, including Newcastle disease and fowl plague. The definitions of "animals" and of "disease" in the principal Acts do not, therefore, have effect in relation to poultry. The Minister may by order extend the above definitions of "poultry" and of "disease" contained in this Section.

Various powers are given to the Minister, to be exercised by the making of orders or otherwise.

These are :—

(*a*) To prescribe and regulate the separation of diseased poultry from poultry not affected with disease, and for the notification of disease. This is in lieu of Section 4 of the Principal Act (*i.e.*, The Diseases of Animals Act, 1894) (Section 2).

(*b*) Power to slaughter in case of disease and to pay compensation (Section 3).

(*c*) Power, by order, to control the import of poultry and eggs in order to prevent the introduction or spreading of disease (Section 4). Sections 24, 25, 27 and 28 of the Principal Act, Section 2 of the Importation of Animals Act, 1922 (Session 2), and Section 3 of the Diseases of Animals Act, 1927, are not to have effect in relation to poultry. The fee payable under the said Importation of Animals Act, 1922 (Section 2) is limited to one penny per bird (Section 4).

(*d*) By order, to prescribe for the cleansing and disinfection of receptacles or vehicles used for the conveyance or exposure for sale of poultry; for the prevention of unnecessary suffering to poultry. The Poultry Act, 1911, is to cease to have effect except as to orders already made thereunder (Section 5).

(*e*) For inspectors to enter to inspect premises where poultry are kept (Section 6).

(*f*) To provide or approve Export Quarantine Stations for the examination of poultry intended for export, and to charge fees therefor (Section 7).

(*g*) To treat with serum and/or vaccine any animal or bird which has been exposed to infection (Section 8).

Compensation is not to be paid for slaughter on import or export (Section 9).

Provision is made for meeting the Minister's costs and expenses.

Part II (*Sections* 11–16).

Part II contains regulations in regard to the manufacture, etc., of the Veterinary Therapeutic substances set out in the First Schedule or others added thereto, and gives power to grant licences in relation thereto. Registered Veterinary Surgeons are exempted from these provisions as regards animals or poultry under their care.

Part III (*General*).

Part I of the Ministry of Agriculture and Fisheries Act, 1919, is extended to Scotland. Certain enactments mentioned in the Second Schedule are repealed.

The Act does not extend to Northern Ireland.

The Housing Act, 1935 (25 & 26 Geo. V., c. 40). Very considerable reference must be made to this important statute which is to prevent overcrowding and to amend the enactments relating to housing. While much of the Act relates to urban districts, much also has to do with rural areas, and it imposes upon landlords (a word which has a wide meaning for the purposes of the Act) duties, failure in the carrying out of which may lead to convictions and fines. It consists of six parts made up of 100 sections and seven Schedules. It has some special provisions as to the housing of members of the agricultural population. Some idea of the importance and effect of the Act will be obtained from the following brief notes upon it.

Part I.

In reading this part of the Act, and the First Schedule, the important definitions contained in Section 12 must be borne in mind. For example, "Dwelling house" means any premises used as a separate dwelling by members of the working classes, or of a type suitable for such use. "Landlord" means the immediate landlord of an occupier; but more, it includes, where an occupier holds under a contract of employment under which the provision of the house for his occupation forms part of his remuneration, his employer; and "Agent" means the person authorized to collect the rent or pay the remuneration. This definition calls for careful consideration. "Room" does not include any room of a type not normally used in the locality, either as a living room or as a bedroom.

By Section 1 the duty is imposed upon every local authority, before such dates as may be fixed by the Minister, to cause an

inspection of their districts to be made with a view to ascertaining what dwelling houses therein are overcrowded, to report to the Minister thereon and as to the provision of the required number of new houses.

Section 2 (1) defines overcrowding, viz.: When the number of persons sleeping in the dwelling house either—

(*a*) is such that any two of those persons, being persons ten years old or more of opposite sexes, and not being persons living together as husband and wife, must sleep in the same room; or

(*b*) is, in relation to the number and floor area of the rooms of which the house consists, in excess of the permitted number of persons as defined in the First Schedule of this Act.

By Section 2 (2) no account is to be taken of a child under one year old, and a child who has attained one year, but is under ten years old, shall be reckoned as half of a unit.

The First Schedule, showing the number of persons permitted to use a dwelling house for sleeping, is as follows:—

"The permitted number of persons" means either—

(*a*) the number specified in the second column of Table I in the annex thereto in relation to a house consisting of the number of rooms of which that house consists, or

(*b*) the aggregate for all the rooms in the house obtained by reckoning, for each room therein of the floor area specified in the first column of Table II in the annex thereto, the number specified in the second column of that table in relation to that area, whichever is the less.

In computing for the purposes of Table I the number of rooms in a house, no regard shall be had to any room having a floor area of less than 50 sq. ft.

ANNEX.

TABLE I.

Where a house consists of:—

(*a*) One room	2.
(*b*) Two rooms	3.
(*c*) Three „	5.
(*d*) Four „	$7\frac{1}{2}$.
(*e*) Five „ or more	10, with an additional 2 in respect of each room in excess of five.

TABLE II.

Where the floor area of a room is:—

(*a*) 110 sq. ft. or more	2.
(*b*) 90 sq. ft. or more, but less than 110 sq. ft.	$1\frac{1}{2}$.
(*c*) 70 sq. ft. or more, but less than 90 sq. ft.	1.
(*d*) 50 sq. ft. or more, but less than 70 sq. ft.	$\frac{1}{2}$.
(*e*) Under 50 sq. ft.	Nil.

By Section 3 if, after "the appointed day" (meaning the day the Minister may fix for the different purposes and different provisions of the Act, and for different localities), the occupier or the landlord of a dwelling house causes or permits overcrowding he is liable on summary conviction to a fine not exceeding £5, and to a further fine not exceeding £2 for every day, subsequent to the day on which he is convicted, on which the offence continues. Provision is made regarding cases where all the persons sleeping in the house were living in the house on the appointed day and thereafter continuously live there, or where children are born after the appointed day, or a child attains one of the ages referred to in Section 2. Here no offence is committed unless alternative accommodation is offered to the occupier after the appointed day and he fails to accept it; or unless suitable accommodation is so offered to some person living in the house who is not a member of the occupier's family and whose removal is reasonably practicable in all the circumstances, and the occupier fails to require his removal. The landlord of an overcrowded house is to be deemed to cause or permit it to be overcrowded—

(*a*) if, after notice of the overcrowding by the local authority, the landlord fails to take such steps as are reasonably open to him to secure the abatement of the overcrowding, including if necessary legal proceedings for possession; or

(*b*) if, when letting after the appointed day, the landlord, or any person effecting the letting on his behalf, had reasonable cause to believe that it would become overcrowded, or failed to make enquiries as to the number, age and sex of persons who would be allowed to sleep in the house;

and not otherwise.

The Minister has power temporarily to increase the permitted number to meet exceptional conditions (Section 4). The local authority also has power to authorize, in exceptional circumstances, the temporary use of a house by persons in excess of the permitted number (Section 5).

Section 6 is a very important one from the landlord's standpoint. As from six months from the appointed day, every rent-book or similar document used in relation to a dwelling house by or on behalf of a landlord, is to contain a summary (in the prescribed form) of the provisions of Sections 2, 3 and 5 of the Act, and a statement of the permitted number of persons in relation to the house. Penalties are attached. The local authority must, on the request of landlord or occupier, state the permitted number of persons. (It will be wise to apply for this because the statement in the rent-book, if it agrees with the information given by the Local Authority, is deemed to be sufficient and correct.)

Section 8 casts upon a landlord the duty to inform the local

authority of overcrowding (unless notice has already been given) within seven days from his having knowledge of the fact; and failure to do so incurs a penalty.

Section 9 gives a landlord the right to obtain possession of overcrowded houses without the restraints imposed by the Rent Restriction Acts, 1920 to 1933; but possession thus obtained does not decontrol the premises. The local authority has power to obtain an order for possession and to recover from the landlord expense incurred in doing so (Section 10).

Sections 13 to 19 contain power to re-develop urban areas; and Section 20 extends the power of local authorities to acquire buildings for housing purposes.

The Authority for the purposes of this part of the Act, outside the City and County of London or metropolitan boroughs, is the council of the borough or urban or rural district (Section 21).

Part II.

This provides for the appointment by the Minister of a Committee, to be called the Central Housing Advisory Committee, to advise the Minister; and local authorities may submit to the Minister a scheme for the establishment of a Commission, under the name of the Housing Management Commission, to carry out the Act.

Part III.

This deals with the financial provisions and among these Section 33 provides that the Minister may, on the recommendation of a Committee (thereinafter referred to as the Rural Housing Committee) appointed by him, undertake to make contributions towards the expense of housing members of the agricultural population. "Agricultural population" has the meaning assigned to it by Section 34 (2) of the Act of 1930, namely, "persons whose employment or latest employment is or was employment in agriculture or in an industry mainly dependent upon agriculture, and includes also the dependants of such persons as aforesaid; the expression 'agriculture' includes dairy farming and poultry farming and the use of land as grazing, meadow, or pasture land, or orchard or osier land, or woodland, or for market gardens or nursery grounds." Sections 37 to 39 amend Subsection (2) of Section (2) of the Housing (Rural Workers) Act, 1926 (which relates to the power of local authorities to make grants or loans under the said Act), as amended by the Housing (Rural Workers) Amendment Act, 1931.

Parts IV, V, VI.

These parts contain powers and provisions deemed necessary to give effect to the working of the Act.

Of the seven Schedules which are set out in the Act the 5th, 6th and 7th deal with various amendments to existing legislation and with certain repeals effected by the Act.

The Restriction of Ribbon Development Act, 1935 (25 & 26 Geo. V., c. 47). The objects of this important Act are (*inter alia*) to provide for the imposition of restrictions upon development along the frontages of roads; to control development in the neighbourhood of roads and other purposes in connection therewith. It is an Act of twenty-six Sections and four Schedules, and gives extensive powers to Highway Authorities as regards land abutting on roads, to which the Act applies.

Section 1 gives a Highway Authority power by resolution to adopt, as regards any road, any standard widths. The resolution has to be approved by the Minister after advertisement and notice and, in some cases, local enquiry. When the Minister's approval has been advertised then the following restrictions are, subject to the provisions of the Act as to exemptions, to be in force, that is to say, it shall not be lawful without the consent of the highway authority :—

(*a*) to construct, form or lay out any means of access to or from the road; or

(*b*) to erect or make any building or permanent excavation, or to construct, form, or lay out, any works upon land nearer to the middle of the road than a distance equal to one-half of the standard width adopted.

The standard widths are those set out in the First Schedule, or other widths which the Minister may by regulation prescribe.

By Section 2 (1) as regards all roads which on the 17th May, 1935, were classified roads, the following restrictions shall, subject to the provisions of the Act as to exemptions, be in force on and after the 2nd August, 1935; that is to say, it shall not be lawful without the consent of the highway authority—

(*a*) to construct, form or lay out any means of access to or from the road; or

(*b*) to erect or make any building upon land within 220 feet from the middle of the road.

By Section 2 (2), the highway authority may by resolution adopt the provisions of this section, as regards any road to which the restrictions aforesaid do not apply under the last foregoing section, and if the resolution is approved by the Minister, after advertisement and notice (and in some cases a local enquiry), the said restrictions shall, subject to the provisions of the Act as to exemptions, apply as respect the road.

Section 2 (3) contains an important exemption. No restrictions in force under this section as to the erection or making of

buildings shall apply in relation to any building which is, or is to be, used mainly or exclusively for the purpose of agriculture otherwise than as a dwelling house, and (except in the case of buildings used or to be used mainly or exclusively for the purposes of horticulture carried on by way of trade or business) occupied together with land used mainly or exclusively for the purposes of agriculture.

By Section 3 (1), exemption is granted for works begun before the date on which the restrictions were first published.

By Section 3 (2) no restriction in force under Section 1 is to apply to any permanent excavation or works necessary in connection with any drains, ditches or other drainage works for agricultural purposes, or to any works necessary for the repair, renewal, enlargement or maintenance of any sewer, drain, electric line, pipe, duct or other apparatus, constructed in or upon the land before the date on which the restrictions came into force, or with the consent of the highway authority on or after that date.

Section 4. Where restrictions are in force under the Act as respects any road, the highway authority may erect and maintain fences or posts for the purpose of preventing access to the road except at such places as may be permitted by them, provided that such fences or posts shall (*inter alia*) not be erected or maintained so as to interfere with any fence or gate required for the purpose of agriculture.

Provisions are made for the formation of a register for purposes of notice of resolutions, for the deposit of plans showing roads subject to restrictions, and for the obtaining of consent from highway authorities (Sections 5, 6, 7 and 8).

Section 9 provides for compensation for injurious affection of land under Sections 1 and 2.

By Section 11, contraventions under Sections 1 or 2 are punishable on summary conviction, and works done may after notice be removed or filled up at the expense of the person committing the contravention, and with a right of appeal to a Court of Summary Jurisdiction.

Section 12 gives the Minister power to remove the restrictions in certain events.

Sections 13 to 23 deal with the acquisition of land by highway authorities, provide an extension of their powers as to parking places, and deal with means of access and general provisions.

Section 24 is the Interpretation clause and is, of course, of great importance. In it, among other definitions, "Agriculture" is defined as including horticulture when carried on as a trade or business, and the use of the land for any purpose of husbandry, whether as arable, meadow, pasture ground or orchard, or for the keeping or breeding of live stock or poultry, or for the purpose of a plantation or a wood, or for the growth of saleable

underwood; and "agricultural" has a corresponding meaning. "Minister" means the Minister of Transport.

By Section 25, the Act, subject to certain modifications, applies to Scotland.

The Finance Act, 1935. Paragraph 4 (*a*) of the Second Schedule to the Finance Act, 1920, which, as amended by the 7th Schedule of the Finance Act, 1933, reads thus :—

> "Locomotive ploughing engines, tractors, agricultural tractors and other agricultural engines, which are not used on a road for hauling any objects except their own necessary gear, threshing appliances, farming implements or supplies of water or fuel required for the purposes of the vehicle or for agricultural purposes"

is amended by Section 4 (2) of The Finance Act, 1935. The amendment consists of the insertion after the words "farming implements" of the words "a living van for the accommodation of persons employed in connection with the vehicle."

II.—Cases in the Courts.

1. Landlord and Tenant.

Lord Deramore v. *Hobson* (79, *Solicitors' Journal* 39 and 187). One of the legal papers describes this case as "the greatest agricultural decision which the Court has given for many years." I have a shorthand note of the judgment before me as I write, and in view of its importance I propose to deal with it somewhat fully.

The defendant was, until the 6th April, 1934, tenant to Lord Deramore of three farms in the East Riding of Yorkshire. Defendant had in fact been tenant of all of them for a considerable number of years; but in 1922, for the first time, he entered, in respect of each farm, into an agreement setting out the terms on which he held; these agreements were in identical terms. The tenancies were yearly and were determined on 6th April, 1934, in pursuance of notices given by the tenant. It was admitted that, subject to the question in dispute in the action, each of the farms was well and highly farmed, and that no complaint of their condition could be made. Before the defendant surrendered his holdings the landlord's agents suspected that the fields on which potatoes were being grown were infected with eelworm. Soil samples taken confirmed eelworm on each farm. The landlord began an action against the tenant claiming £1,800 damages on the ground that he, the tenant, had broken the express terms of his tenancy agreements by failing to manage the farms in a husbandlike manner, and their implied terms by failing to farm his holdings in accordance with the custom of the

country. The action was heard by Mr. Justice Porter at Leeds in December, 1934, and his Lordship gave judgment in London on the 11th January, 1935. The following remarks are taken from the judgment. His Lordship dealt at length with the scientific evidence given before him as to the potato eelworm (*Heterodera schactii*). No practical method of ridding the soil of eelworm had been found, other than by ceasing to grow potatoes until all the larvæ had died, a process which might take seven or more years. The Judge was satisfied that the existence and habits of the eelworm were not known, except very vaguely, and that only in some instances, to farmers or to agricultural valuers; and in particular he was satisfied that they were unknown to the defendant. The plaintiff's complaint was not that the soil was infected—the infection came without any fault of the defendant, but the complaint was on account of an increase in infection due to the planting of potatoes more than once in five years.

His Lordship had to determine (1) whether so planting is contrary to good husbandry, apart from any custom of the country; (2) whether there is a custom of the country to plant potatoes not more often than once in five years; (3) whether such a custom can be incorporated in the contract between the parties, and whether, if such a custom exists and can be incorporated, the defendant had broken his contract.

(1) Apart from the question of custom, the Judge did not think he could hold that to plant potatoes more than once in five years was unhusbandlike. *It did not of course follow that in the future, now that the danger of eelworm was better known, that twice cropping in five years would be in accordance with good husbandry.*[1] A tenant knowing of the existence, or of the possibility of the existence of eelworm, on his holding, would break his contract to farm in a husbandlike manner if he were to grow more than one crop of potatoes in five years. That might be true of the future; it was not true of the past.

(2) He found there was such a custom. The question was further complicated by the freedom of cropping conditionally given by Section 30 of the Agricultural Holdings Act, 1923. On this finding his Lordship referred to *Leigh* v. *Hewett* (1803, 4 East, p. 156).

(3) Could a custom be incorporated into this contract? Yes, and must be if it were not inconsistent with the terms of the contract.

(4) The defendant in these circumstances had broken his contract, subject to any defence he might have under the said Section 30. Sub-section 2 of Section 30 shut out this defence.

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[1] The italics are mine.—A. E.

It was said that the only method of ridding land of eelworm, other than the non-planting of potatoes, was a treatment at the cost of £300 per acre, which was not commercially possible.

(5) What damage flowed from that breach? The farms were rented as farms, and the damage was the loss to the reversion, that is to say, the loss of rent obtainable for the farms, as farms, in consequence of the increase of infection by twice cropping with potatoes in five years. His Lordship found that there was a yearly loss of rent of £75, £80 and £35, or a total of £200, and he took this at two and a half years. Judgment was given for the plaintiff for £500 and costs.

Lord Eldon v. *Hedley Brothers C.A.* (1935, 2 K.B. 1). The decision of the Court of Appeal in this case was one of considerable importance. A yearly tenant agreed in his tenancy agreement (*inter alia*) not to dispose of any hay grown on or brought to the farm, but to consume such hay by stock on the farm. During the tenancy he entered into contracts for the sale to the defendants of a number of stacks of hay standing on the farm. When that sale was made no one knew or suspected that the year in question would in fact become the year before the tenant quitted the holding. It became so because of an agreement subsequently made with the landlord to surrender the premises. While the defendants (the purchasers) were in process of preparing the stacks for removal the landlord levied a distress on the farm for rent. The defendants, notwithstanding, removed the hay in the stacks sold to them, serving on the landlord a declaration in writing under Section 1 of the Law of Distress Amendment Act, 1908, namely, that the tenant had no right of property or beneficial interest in the goods distrained. The landlord brought an action against the defendants under Section 3 of the Sale of Distress Act, 1689, for treble damages for pound-breach, and, alternatively, for damages for the removal of the hay, contrary to Section 11 of the Sale of Farming Stock Act, 1816. That section in effect provided that a purchaser of goods or crops from any person engaged in husbandry, or any lands let to farm, should have no right to deal with that which he had purchased in any other manner than the seller was entitled to deal with it if there had been no such sale. What then were the tenant's rights as to dealing with the hay in question, having regard to the said agreement? Here consideration had to be given to the effect of a much later Act, namely, Section 30 (1) of the Agricultural Holdings Act, 1923. That sub-section frees an agricultural tenant from any obligation, by contract which he may have made, with regard to the disposal of the produce of the holding, provided he has previously made provision for the return to the holding of the full equivalent manurial value of all crops, etc., sold by him in contravention of his

contract; but this provision was not to apply in respect of the year before the termination of the tenancy.

Had this last enactment impliedly repealed Section 11 of the Sale of Farming Stock Act, 1816?

On the trial the late Mr. H. H. Joy, K.C., Commissioner of Assize, held that the property in the hay passed on the making of the contracts, and that the claim for pound-breach failed. He also held that the plaintiff's claim for damages, for breach of Section 11 of the Sale of Farming Stock Act, 1816, failed because, when the contracts were made, neither landlord, tenant, nor purchasers could have known that the tenancy would end within the year; and therefore Section 30 (1) of the Agricultural Holdings Act, 1923, applied. On appeal the Court of Appeal held:—

(1) That the property in each of the stacks passed to the buyers at the date of the contracts for sale and, in view of the notice given as required by the Law of Distress Amendment Act, 1908, no claim arose in respect of pound-breach.

(2) That the provision of Section 11 of the Sale of Farming Stock Act, 1816, applied to any purchaser, and not merely to a purchaser from a bankrupt, or under an execution.

In this case the tenant was not freed from the obligations of his contract by reason of Section 30 (1) of the Act of 1923, because there was no evidence that he made any provision for the return to the holding of the full equivalent manurial value; nor could he acquire any benefit from Section 30 (1), as the sale and the removal of the hay took place in the year before he quitted the holding. The farmer was, therefore, a person who, by reason of his contract of tenancy, ought not to have disposed of the hay otherwise than as provided in the tenancy agreement.

The appeal was allowed, judgment being entered for the plaintiff for £102 damages with certain costs. It will be observed that the ignorance of the purchasers, and indeed of the sellers, that the transaction was in the year before the tenant quitted, was not material.

Section 11 of the Sale of Farming Stock Act, 1816, has not been impliedly repealed by Section 30 of the Agricultural Holdings Act, 1923.

Ecclesiastical Commissioners for England v. *National Provincial Bank, Limited, C.A.* (1935, 1 K.B. 566).—By Section 57 (1) of the Agricultural Holdings Act, 1923, it is provided "in this Act, unless the context otherwise requires, 'tenant' means the holder of land under a contract of tenancy, and includes the executors, administrators, assigns, guardian, committee of the estate, or trustee in bankruptcy, of a tenant or other person deriving title from a tenant."

By Section 5 (7) of the Agricultural Credits Act, 1928, it is provided that " for the purposes of this Part of this Act . . . " " other agricultural assets " means a tenant's right to compensation under the Agricultural Holdings Act, 1923, for improvements, damage by game, disturbance or otherwise, and any other tenant right.

The tenant of an agricultural holding charged, in favour of a bank, his farming stock and other agricultural assets. Subsequently the tenant served on the landlords a notice to quit, and he duly quitted the holding. He was later adjudicated a bankrupt.

It was held that the expression " tenant " in Section 57 (1) of the Agricultural Holdings Act, 1923, did not include a mere assign of " farming stock and other agricultural assets," or an assign of the tenant's right to compensation under that Act, and that, therefore, the bank in whose favour the tenant had charged his " farming stock and other agricultural assets " was not entitled to go to arbitration with the landlords under Section 16 of the Agricultural Holdings Act, 1923.

The question came before the Court of Appeal on a Special Case stated by the arbitrator, the County Court Judge having held that there was no valid submission to arbitration by reason of the fact that the bank never were tenants of the holding within the meaning of the Agricultural Holdings Act, 1923.

Hassall v. *Cholmondeley* (*Marquess of*) (*The Estates Gazette*, July 6th, 1935, p. 12).—If an arbitrator purports to deal in his award, under an Agricultural Holdings Act, 1923, Arbitration, with a question not submitted to him (in this case the value of certain fixtures), has the County Court Jurisdiction to set the award aside ?

The Court of Appeal said " yes." The point as to whether the value of fixtures could ever be determined in an arbitration under the Agricultural Holdings Act, 1923, was reserved.

Hinds v. *Davies* (*The Estates Gazette*, March 23rd, 1935, p. 496).—The tenants of a farm in Brecon claimed compensation for disturbance. Before the termination of the tenancy, and before the removal from the farm-house, verbal particulars were given to the landlord of what the tenants' valuer said was the claim. It will be remembered that compensation for disturbance is, *inter alia*, in respect of such loss or expense, directly attributable to the quitting of the holding, as the tenant may unavoidably incur in respect of the matters mentioned in Section 12 (6). The question was whether those verbal particulars, given before the loss was sustained, complied with the Agricultural Holdings Act, 1923, Section 16 (2). The arbitrator referred the case for the opinion of the County Court Judge, who held that the particulars satisfied the Act. The Court of Appeal took a contrary view and said they did not.

2. Labour.

In *re Wroot* (1935, 179 L.T. 309; 79 S.J. 343) a question arose under the Unemployment Insurance Act (now repealed and re-enacted by the Unemployment Insurance Act, 1935) as to whether one, Wroot, was a person employed in Agricultural employment and therefore not insurable under the Act. His work was to clear drains and keep them clear of mud and obstruction; during the summer months he had to keep down the grass on the sides of the drain and weed. His employers were Drainage Commissioners. The Minister held he was not a person engaged in agricultural employment. Branson J. took the contrary view that Wroot was engaged in agriculture: the character of the work was not altered because it was done by a statutory body instead of by individuals.

3. Tithes.

Wither v. *Spicer*; *Rawlence & Squarey* v. *same* (C.A. (1935) 1 K.B. 412, 51 T.L.R. p. 89).—These two Appeals came before the Court of Appeal, and were from the refusal of the County Court Judge to grant two applications for Orders for the issue of a second distress in respect of unpaid tithe rent charge. The respondent to both appeals was Mr. Tom Spicer, who was the owner and occupier of the farm out of which the tithe rent charge issued.

The respondent did not pay either of the tithe rent charges payable. The total due in the two cases amounted to about £30. Orders for payment were duly made in the County Court, and an Order for payment by distress.

The officer seized three hayricks of the market value of £170. The bailiff found it impossible to get any auctioneer to sell the ricks in the ordinary course, and thereupon an application was made to the County Court Judge to give a direction for a sale by tender. No tenders in the ordinary course were forthcoming. Only two were received, one for £9 and the other (from Mr. Spicer himself) for £10, and the officer accepted the tender from the respondent. The costs of the distress were £13 9s. 4d. The balance of £3 9s. 4d. had to be paid by the Tithe owners, and they obtained nothing in respect of their claim for £30.

An application by the parties entitled to the tithe rent charge for an Order for a second distress was refused by the County Court Judge. It was from this Order that the applicants appealed.

The Court of Appeal held that the case was excepted from the general rule of law that a second distress cannot be made for the same sum, on either of these grounds:—

(1) That the officer, in levying the first distress, had in the circumstances made a *bona fide* and excusable mistake

in underestimating the true value of the hayricks seized.

(2) That the misconduct of the landowner himself had contributed to prevent the first distress from being effective.

The case was remitted to the County Court Judge, who in the exercise of his judicial discretion, should make such an Order, and, if necessary, give such further directions as were in accordance with the principles of law which the Court had laid down.

Under Section 10 (2) of the Tithe Act, 1891, the proceedings which are required to be commenced before the expiration of two years from the date at which the sum on account of tithe rent charge became payable, are the original proceedings for the recovery of that sum, and not proceedings subsequently initiated by direction of the County Court under Section 2 (2) of the Act.

4. Rates and Taxes.

Drainage Rate—Lodge v. *Lancaster C.C.* (32 L.G.R. 353, Divisional Court).—Drainage Boards had power to levy rates either on the basis of acreage or of annual value (Land Drainage Act, 1918 (4) (1)). The Lancaster County Council levied a rate on the basis of acreage. They had power, under an Order made by the Minister of Health in 1927 under the authority of a local Act, to require occupiers of land, less than one acre in extent, to commute the rate. This power the Council exercised and the occupier commuted the rate. Then came the Land Drainage Act, 1930, which by Section 24 (4) required every rate to be an annual-value rate. The authority then made a rate on Lodge on such an annual-value basis, arguing that this rate was a new rate to which the commutation agreement did not apply. The matter came before the Divisional Court, which held that the 1930 Act did not impose a new rate, but fixed upon one of two alternative methods of assessing the existing rate ; the ratepayer had commuted that rate and was not liable to be further assessed in respect of it.

Commissioners of Sewers for Louth v. *Cheffings* (*The Estates Gazette*, May 11th, 1935, p. 844).—The Commissioners made a drainage rate on annual value based on income tax assessment. No appeal was made against the rate but, two months before the rate was made, the landlord lodged an appeal against the income tax assessment. That appeal was successful, but the result was not given until after the drainage rate had been made and sealed. Mr. Cheffings claimed that he should have the benefit of the reduced tax assessment, a view which the magistrates sustained.

By Section 24 (4) of the Drainage Act, 1930, the drainage rate is to be upon the gross annual value as determined for the purposes of Income Tax. Section 26 of the said Act provides that every rate made shall be deemed to be made on the date on

which a resolution is passed by the Board authorizing their seal to be affixed to the rate. The Divisional Court allowed the appeal. At the time the rate was made it was based on the proper annual value; moreover, Mr. Cheffings had entered no appeal against the rate.

Dennis v. *Hick* (*The Estates Gazette*, May 25th, 1935).—The old question as to whether the growing of vegetables in large open fields, the usual instruments of farming being employed, constituted an occupation of the lands as "gardens for the sale of the produce" within the meaning of Rule 8 of Schedule B, arose in this case. The General Commissioners found that the lands in question were so occupied.

Mr. Dennis appealed.

Mr. Justice Finlay dismissed the appeal on the ground that the question was one of fact, and the Court would not interfere with findings of fact where there was evidence on which to arrive at such findings. (*Note.*—Many a farmer growing vegetables may be faced with an attempt to bring him within Rule 8 and have this case cited against him. The only proposition which it supports is the finality of the finding of facts by the Commissioners if there is any evidence to support such finding.)

5. Marketing Schemes.

Milk Marketing Board v. *Williams* (79 S.J. 363: C.A.: W.N. 82).—This was an appeal by the Board from the judgment of the Westminster County Court. In 1933 the defendant, a farmer, became a registered producer under the Milk Marketing Scheme. At that time he had six milch cows kept for milking, but this number was afterwards reduced by him to four.

Under paragraph 40 of the Scheme, producers who had for the time being in their possession, in England and Wales, not more than four milch cows were, unless they sold milk by retail, exempt from registration and from the operation of the scheme.

In August, defendant was charged before the Milk Marketing Board for that he, being a registered producer, had sold milk wholesale contrary to paragraph 58 of the Scheme, under a contract which did not contain all the terms prescribed by the Board. The Board imposed a penalty of £20. The money was not paid and the Board sued in the County Court for the debt. The County Court Judge held that, as the defendant had only four milch cows and was only selling wholesale, he was exempt from the operation of the Scheme by paragraph 40 thereof, and that the Board were not entitled to impose a penalty. The Board appealed. The Court of Appeal allowed the appeal. Under paragraph 41 of the Scheme the Board could not remove his name, because he was exempt, without his consent. He had

remained on the register, and was therefore a registered producer and liable to the penalty imposed by the Board.

6. Miscellaneous.

Railway Company's Liability to Fence.

Symons v. *Southern Railway Company* (79 S.J. 434; *The Estates Gazette*, May 25th, 1935, p. 928).—Mr. Symons was the owner and occupier of Ridgegrove Farm, Launceston. Two sheep belonging to him strayed from his field, through a gap in a hedge bordering the railway, and were killed on the line by an engine. Mr. Symons sued the Railway Company in the County Court and obtained judgment for £5. The Company appealed to the Court of Appeal.

The facts were shortly as follows :—

(1) The railway was constructed in 1885, when 4 acres of Ridgegrove Farm were purchased by the constructors; (2) the conveyance stated that it had been agreed that the purchase price should include compensation for accommodation works, including fences, which the vendor might otherwise be entitled to claim; (3) Samuel Symons, plaintiff's father, was then in occupation as a yearly tenant, and continued in occupation of the remainder; (4) fences or hedges were erected by the Company and had since been maintained by them; (5) in 1911 Samuel Symons purchased the remainder of the farm; (6) in June, 1932, Samuel Symons having died, the land was conveyed to the plaintiff.

Section 68 of the Railway Clauses Consolidation Act, 1845, imposes upon Railway Companies an obligation to maintain fences, but the Companies are not to be required to make accommodation works in respect of which the owners and occupiers have agreed to receive, and have been paid, compensation instead.

The appeal was dismissed. The Master of the Rolls said the agreement of 1885 barred any claim by the owners but did not prevent a claim by the occupying tenant. It had to be considered whether the rights of the plaintiff and his father had been lost by the coalescing of the tenancy in the freehold. His Lordship held there was no merger such as to deprive the plaintiff's father of his right to have the hedge maintained, and that that right still remained in the plaintiff. Leave to appeal to House of Lords was refused.

Alfred Ellis.
(Ellis & Fairbairn).

22, Bedford Row, W.C.1.

AGRICULTURAL STATISTICS, 1935.

THE following table gives a summary of the acreages of crops and grass, and the numbers of live stock returned by occupiers on June 4th, 1935, together with the corresponding figures for 1934.

Acreage Under Crops and Grass and Numbers of Live Stock *on holdings above one acre in extent in England and Wales as returned by occupiers on June 4th,* 1935, *and June 4th,* 1934.

(The figures for 1935 are subject to revision.)

Distribution.	1935.	1934.	Increase (+) or Decrease (—).
	Acres.	Acres.	Acres.
Total Acreage under all Crops and Grass	24,948,000	25,030,000	— 82,000
Rough Grazings[1]	5,422,000	5,424,000	— 2,000
Arable Land	9,394,000	9,250,000	+ 144,000
Permanent Grass for Hay	4,637,000	4,823,000	— 186,000
" " not for Hay	10,917,000	10,958,000	— 41,000
Wheat	1,771,000	1,759,000	+ 12,000
Barley	793,000	861,000	— 68,000
Oats	1,416,000	1,402,000	+ 14,000
Mixed Corn	94,000	96,400	— 2,400
Rye	20,600	17,500	+ 3,100
Beans for stock feeding or seed	133,100	151,900	+ 1,900
Beans for market or canning	20,700		
Peas for stock feeding or seed	42,300	143,000	— 10,200
Peas for canning or packeting green or dried	26,900		
Green Peas for market	63,600		
Potatoes, first earlies	55,100	487,600	— 24,900
Potatoes, Main Crop, including second earlies	407,600		
Turnips, for stock feeding or seed	199,000	520,400	— 23,000
Swedes, for stock feeding or seed	276,300		
Turnips and Swedes for human consumption	22,100		
Mangolds	250,700	246,400	+ 4,300
Sugar Beet	367,200	396,300	— 29,100
Kohl Rabi and Rape	57,200	62,900	— 5,700
Cabbage, Savoys and Kale for fodder	112,500	74,000	+ 38,500
Cabbage, Savoys, Green Kale and Sprouting Broccoli for human consumption	37,500	37,000	+ 500
Brussels Sprouts	34,100	34,000	+ 100
Cauliflower or Broccoli (non-sprouting)	19,500	20,100	— 600
Carrots	15,800	16,400	— 600
Vetches or Tares	53,700	52,600	+ 1,100
Lucerne	35,900	34,200	+ 1,700
Hops	18,000	18,000	—
Small Fruit	59,800	61,000	— 1,200
Orchards	262,100	254,900	+ 7,200
Clover and Rotation Grasses for Hay	1,388,000	1,290,000	+ 98,000
" " " not for Hay	945,000	783,000	+ 162,000
Bare fallow	286,000	340,000	— 54,000
Horses used for Agricultural purposes (including Mares for breeding)	586,000	596,300	— 10,300
Unbroken Horses (including Stallions) One year and above	96,000	87,700	+ 8,300
Unbroken Horses (including Stallions) Under one year.	47,000	43,800	+ 3,200
Other Horses	144,500	157,000	— 13,300
TOTAL OF HORSES	873,500	885,600	— 12,100

[1]Mountain, Heath, Moor, Down and other rough land used for grazing.

Distribution.	1935.	1934.	Increase (+) or Decrease (—)
	Acres.	Acres.	Acres.
Cows and Heifers in Milk	2,231,000	2,213,900	+ 17,100
Cows in Calf but not in Milk	382,200	363,900	+ 18,300
Heifers in Calf	436,500	417,300	+ 19,200
Other Cattle: Two years old and above	1,008,600	1,041,400	— 32,800
Other Cattle: One year and under two	1,313,600	1,369,100	— 55,500
Other Cattle: Under one year	1,166,700	1,254,600	— 87,900
TOTAL OF CATTLE	6,538,600	6,660,200	—121,600
Ewes kept for breeding	7,120,700	7,308,300	—187,600
Other Sheep: One year and above	1,775,900	1,702,600	+ 73,300
Other Sheep: Over six months and under one year	438,600	528,500	— 89,900
Other Sheep: Under six months	7,135,500	6,987,600	+ 147,900
TOTAL OF SHEEP	16,470,700	16,527,000	— 56,300
Sows kept for breeding	493,900	450,400	+ 43,500
Other pigs	3,317,800	2,869,800	+ 448,000
TOTAL OF PIGS	3,811,700	3,320,200	+ 491,500

Of the cereal crops, wheat, oats and rye show small increases, the wheat increase being mainly confined to the Eastern and North Eastern districts. However, a further considerable decline of 7·9 per cent., or 68,000 acres, in the area under barley offset the other cereal increases, so that the total area under all cereals in 1935 was 1 per cent., or 41,300 acres, less than in 1934.

A noteworthy feature of the 1935 statistics is the substantial addition to the acreage under clover and rotation grasses, which amounted to 260,000 acres, or 12·5 per cent. Of this, the total not for mowing was, at 945,000 acres, 20·7 per cent. greater than in 1934, and the largest figure shown for many years. However, the total area under meadow hay (4,637,000 acres) shows a decline of 186,000 acres (3·9 per cent.). Altogether the area of hay was 88,000 acres less than that of 1934.

Potatoes show a further decline of 24,900 acres (5·1 per cent.). This figure includes all areas under the crop, from 1 quarter acre upwards, and is greater than that given by the Potato Marketing Board, which included only areas of 1 acre or more grown by Registered Producers. There was a total reduction in the area under roots, mainly attributable to a 4·4 per cent. reduction in turnips and swedes, which wiped out the small increase of 4,300 in the mangold acreage. The decrease of 23,000 acres in turnips and swedes has brought the area under these crops to a new low level, and continues the downward trend which has been evident for so many years. On the other hand, there was a marked increase in the area under cabbage, savoys and kale for fodder, the 1935 figure of 112,500 acres being 52 per cent. greater than it was in the previous year.

Having in view the limit imposed by Government on the amount of sugar beet eligible for subsidy, the decrease of 29,100 acres was perhaps to be expected.

The small but steady increase in vegetable crop areas is being maintained, except that this year carrots and cauliflower or broccoli suffered declines amounting to some 600 acres in each case.

Slight changes are made in the classification of some crops. For instance, with turnips those destined for stock feeding or seed are differentiated from those for human consumption. It will be possible in future to note the proportions of these crops grown for stock and for the market-garden produce market respectively.

So far as cattle are concerned, the dairy herd continues to increase—the total of 3,049,700 being a new maximum; there is, however, a reduction in the total cattle of the country owing to the greater decline in the numbers of "other cattle." The beef outlook continues to assert its influence on the numbers of calves reared, this year's figures showing a further reduction of 87,900.

The number of ewes kept for breeding, as was expected, fell by 187,600, but the numbers of sheep "under six months" show an increase this year of 147,900. The total number of sheep in the country showed only a small decrease (56,300, or 0·3 per cent.).

Pigs continue to show an increase. The total in 1935 was 3,811,700, and the number of sows kept for breeding increased by 43,500 over the previous year's figure.

The number of horses used for agricultural purposes fell again, by 10,300, to 586,000, but unbroken horses and stallions again show increases.

THE NEWCASTLE SHOW, 1935.

With the holding of the 94th annual exhibition at Newcastle, from Tuesday, July 2nd, to Saturday, July 6th, 1935, the Tyneside City again takes the lead in having received the Royal Show more often than any other municipality in the country. This year's Show marked the sixth occasion upon which the Royal Agricultural Show has visited Newcastle.

It also recorded a unique event in the life of the Chief Official of the Corporation, for the present Town Clerk of Newcastle (Sir Arthur Oliver) has acted as Hon. Secretary of the Local

Committee of the three Shows of 1908, 1923, and 1935 held on the Town Moor.

In spite of the industrial depression prevailing on Tyneside and in the North East of England, the Show was an unqualified success.

Some details of the six Newcastle Shows are given in the table below :—

Year.	President.	No. of Implement, etc., Stands	Entries of Live Stock.	Amount of Prizes.	Persons paying for Admission.	Financial Result. + = Profit. − = Loss.
				£		£
1846	Lord Portman	109	613	1,391	No record.	− 2,138
1864	2nd Lord Feversham	263	1,099	3,195	114,683	+ 1,342
1887	2nd Lord Egerton of Tatton	283	1,825	6,760	127,372	− 2,029
1908	Duke of Devonshire	389	2,619	10,560	213,867	+ 10,054
1923	Lt.-Col. E. W. Stanyforth	453	3,670	14,750	186,510	+ 19,102
1935	H.R.H. The Duke of Kent	356	3,049	16,034	133,520	+ 6,505

The location of the 1935 Show having been decided upon, the County Agricultural Societies of Northumberland and Durham readily agreed to give up their own annual fixtures and to throw in their lot with the National Society. The cordial co-operation of these two bodies through their respective Secretaries was invaluable, and helped in a very large measure to bring about the happy result.

The spacious Town Moor again provided a most excellent showground, with adequate open spaces for the parking of the numerous motor vehicles of members, exhibitors and visitors. On this occasion the main entrance building, with its secretarial and other administrative offices, was erected alongside the Great North Road. Transport of visitors to the Show was greatly facilitated by the frequent service of trams and buses. Other public entrances gave access from Claremont Road and from the northern side of the Moor, and these enabled visitors from the north-west and west to gain easy access to the showyard without the delay experienced in travelling through the streets of the city when somewhat congested with traffic.

The area enclosed (87 acres) was less extensive than in 1923, but the greater part of the land used this year also did duty as a showground on the last occasion, although the layout was to some extent different.

The Corporation and the Stewards and Freemen undertook the preparation of the site and the laying-on of gas and water. Much levelling had to be done, particularly in the area used for

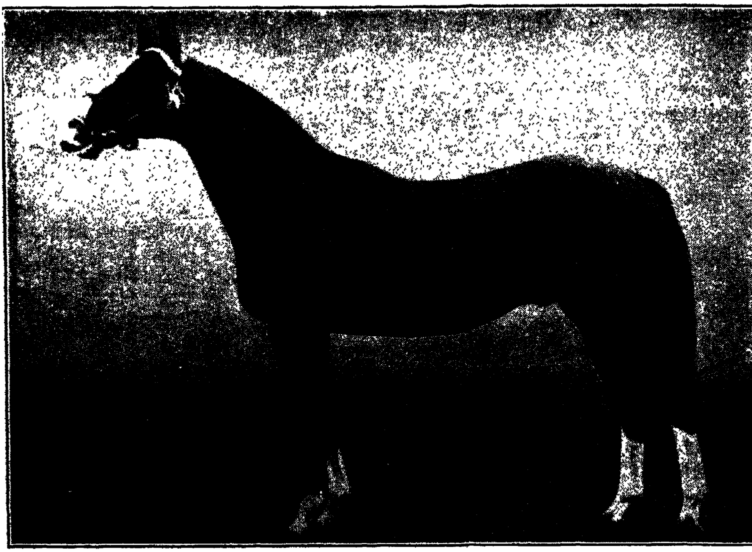


FIG. 1.—POLO AND RIDING PONY STALLION, "SILVERDALE TARRAGON."
Winner of Champion Prize for best Polo and Riding Pony Stallion or Colt, Newcastle, 1935.
Exhibited by MR. H. BRIGHT.

FIG. 2.—POLO AND RIDING PONY MARE, "ROSINE."
Winner of Champion Prize for best Polo and Riding Pony Mare or Filly, Newcastle, 1935.
Exhibited by CAPTAIN FRANCE-HAYHURST.

the "Grand Ring," but this will result in a permanent improvement to that portion of the Moor, and cricket pitches and football grounds will doubtless be found there next season.

Imperial Chemical Industries kindly undertook the special treatment of the turf in the ring, and excellent results were obtained.

Considerable use this year was made of electricity, provided by the North East Electric Supply Company, for power, heating and lighting. For the first time, electricity was utilized for all necessary purposes in the Working Dairy in the showyard. In addition, a supply was provided for some fifty-five exhibitors' stands in the Machinery section.

Another innovation had for its object the provision of greater assistance to visitors in finding their way about the ground. Eight separate "Posts" were established in different sections. At each of these a large coloured plan of the Show was set up and "Guides" (for which duty Armstrong College students volunteered their services) were in attendance to direct visitors and to answer their enquiries. In addition direction signposts were used to a greater extent than on any former occasion.

Prizes this year reached an aggregate value of £16,034, a figure which has once only been exceeded, viz., at Chester ten years ago, when a record sum was offered. The several Breed Societies provided £3,500, and upwards of £2,000 came from other sources.

In the Horse section classes for teams of animals of the four heavy draught breeds, which were such an attractive feature at Ipswich, were repeated at Newcastle, and proved equally as interesting as on the former occasion. There were special classes for Dale, Fell, Mountain and Moorland Ponies. In the Cattle section classes were added for the picturesque Highland breed. Classes were also introduced in the Sheep section for the Hill breeds more especially identified with the north country.

Local classes were provided for cattle belonging to members of the Agricultural Societies of Northumberland and Durham residing or occupying land in those counties.

Quite a new departure was the offer of prizes in a number of classes for cattle owned by members of Young Farmers' Clubs in Northumberland and Durham.

A classification for Eggs was added to the Produce section on this occasion.

Following will be found a comparative statement showing the Classes, Prizes and Entries at the two last Newcastle Shows, and a statement comparing this year's entries with those of several previous years.

Fig. 3.—Blue Albion Bull, "Snarestone Baron."
Winner of Champion Prize for best Blue Albion Bull, Newcastle, 1935.
Exhibited by Mr. C. H. Goodwin.

Fig. 4.—Blue Albion Cow, "Mount Crocus 3rd."
Winner of Champion Prize for best Blue Albion Cow or Heifer, Newcastle, 1935.
Exhibited by Mr. W. E. Glover.

At two Shows held at Newcastle-on-Tyne in 1923 *and* 1935.

Horses, Cattle and Goats.	1923. Classes	1923. Entries	1935. Classes	1935. Entries
HORSES :—				
Prizes		£4,397		£3,564
Shire	12	74	11	58
Clydesdale	9	75	10	63
Suffolk	9	43	13	77
Percheron	7	65	9	50
Hunter—				
Breeding Classes	10	81	10	81
Riding Classes	6	90	7	100
Polo and Riding Pony—				
Breeding Classes	5	24	5	20
Hack and Riding Ponies	5	—	1	10
Arab	2	10	—	—
Cleveland Bay and	4	9	—	—
Coach Horse	2	3	—	—
Hackney	5	20	—	—
Hackney Pony	3	8	—	—
Dale Pony	6	39	2	7
Fell Pony	2	12	3	22
Moorland Pony	—	—	2	20
Shetland Pony	2	26	2	11
Welsh Pony	3	9	2	7
Children's Pony	—	—	3	23
Driving Classes	11	76	9	54
Pit Pony	—	—	5	70
Mounted Police	—	—	1	27
Jumping	4	90	5	112
Total for HORSES	107	754*	100	812*
CATTLE :—				
Prizes		£5,267		£6,599
Shorthorn	11	180	11	90
Hereford	7	49	9	30
Devon	5	20	5	24
Sussex	5	20	5	16
Welsh	5	32	5	— ‡
Park Cattle	2	8	—	—
Longhorn	—	—	4	13
Aberdeen-Angus	6	55	6	85
Belted Galloway	4	20	4	22
Galloway	5	33	4	40
Highland	—	—	4	38
Dairy Shorthorn	11	163	10	159
Lincolnshire Red Shorthorn	7	62	7	44
South Devon	5	21	4	— ‡
Red Poll	6	60	8	87
Blue Albion	4	41	5	22
British Friesian	9	166	13	108
Ayrshire	6	39	7	79
Guernsey	5	42	7	74
Jersey	7	101	7	96
Kerry	5	36	4	19
Dexter	5	37	4	14
Milk Yield	11	155	11	95
Butter Test	2	112	2	55
Total for CATTLE	133	1,452*	146	1,210*
GOATS :—				
Prizes		£84		£147
Inspection Classes	12	74	12	68
Milk Yield	2	29	2	39
Total for Goats	14	103*	14	107*

Sheep, Pigs, Poultry, and Produce.	1923. Classes	1923. Entries	1935. Classes	1935. Entries
SHEEP :—				
Prizes		£2,154		£2,504
Oxford Down	5	53	5	39
Shropshire	6	44	5	32
Southdown	6	47	7	69
Hampshire Down	5	34	5	32
Suffolk	6	69	8	71
Dorset Down	3	12	3	16
Dorset Horn	—	—	3	14
Wiltshire Horn	—	—	3	9
Ryeland	5	36	4	12
Kerry Hill (Wales)	4	13	5	25
Clun Forest	—	—	5	38
Lincoln	6	42	4	19
Leicester	4	48	4	32
Border Leicester	4	61	4	40
Half-bred	3	11	3	23
Wensleydale	5	33	5	24
Kent or Romney Marsh	6	61	6	43
Cotswold	4	15	—	—
South Devon	—	—	2	—‡
Dartmoor	—	—	2	7
Exmoor	3	6	—	—
Lonk	—	—	2	7
Swaledale	5	30	4	26
Herdwick	3	12	3	10
Rough Fell	—	—	3	10
Cheviot	4	40	6	50
Black-face Mountain	4	46	4	15
Welsh Mountain	2	8	2	13
Black Welsh Mountain	2	7	2	8
Total for SHEEP	95	728	109	684
PIGS :—				
Prizes		£1,697		£1,549
Large White	8	158	8	169
Middle White	8	190	8	73
Tamworth	6	17	6	26
Berkshire	8	111	8	48
Wessex Saddleback	6	52	6	46
Large Black	8	262	8	50
Gloucestershire Old Spots	8	124	6	27
Lincolnshire Curly Coated	5	29	—	—
Cumberland	5	50	4	25
Essex	6	55	6	50
Long White Lop-Eared	—	—	5	17
Welsh	—	—	4	14
Bacon Pigs	—	—	2	26
Porkers	—	—	2	22
Total for PIGS	68	1,048	73	593
POULTRY :—				
Prizes		£436		£418
Entries	143	1,189	124	668
RABBITS :—				
Prizes		£108		
Entries	42	291	—	—
PRODUCE :—				
Prizes		£246		£319
Entries	37	436	44	333

Grand Totals for LIVE STOCK, POULTRY, PRODUCE, Etc.	1923	639 Classes	6,001 Entries	£14,750§
	1935	610 Classes	4,407 Entries	£16,084†

* Animals exhibited in more than one class are here counted as separate entries.
§ Including £300 for Flower Show and £60 for Local Classes.
† Including £435 for Flower Show, £78 for Butter-Making Competitions, and £121 for Local Classes.
‡ Classes cancelled under regulation of Prize Sheet.

FIG. 5.—BRITISH FRIESIAN BULL, "SARACENS GENERAL."
Winner of Champion Prize for best British Friesian Bull, Newcastle, 1935.
Exhibited by MR. G. B. RADCLIFFE.

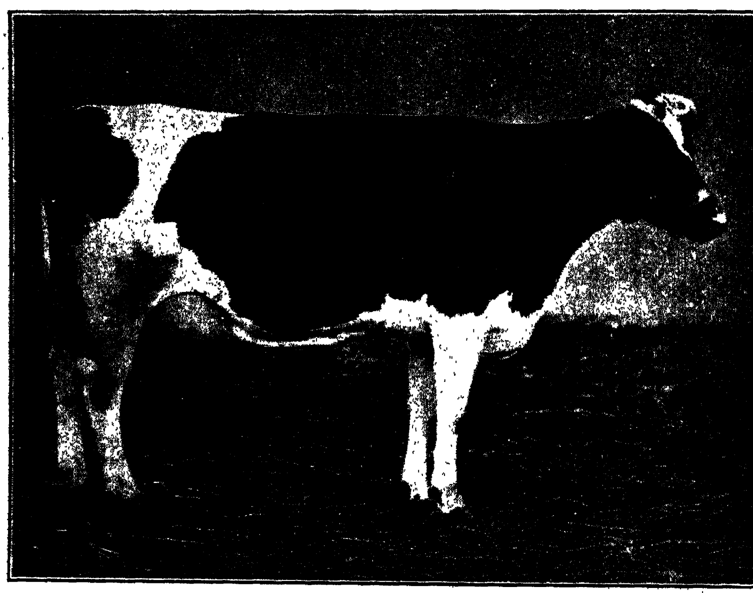


FIG. 6.—BRITISH FRIESIAN COW, "TERLING BREEZE 34TH."
Winner of Champion Prize for best British Friesian Cow or Heifer, Newcastle, 1935.
Exhibited by LORD RAYLEIGH.

STATEMENT OF ENTRIES FOR THE 1935 SHOW, COMPARED WITH PREVIOUS YEARS.

Live Stock, Poultry and Produce.

	Newcastle, 1935.	Ipswich, 1934.	Derby, 1933.	Southampton, 1932.	Warwick, 1931.	Manchester, 1930.	Harrogate, 1929.	Nottingham, 1928.	Newcastle, 1923.
Horses .	*644	*729	*592	*437	*568	*512	*634	*607	*641
Cattle .	*1,060	*1,281	*1,149	*1,009	*1,168	*1,164	*1,263	*1,261	*1,185
Goats .	*68	*107	*97	*75	*68	*48	*92	*61	*68
Sheep .	684	576	573	520	569	735	723	591	728
Pigs .	593	841	688	551	688	678	691	833	1,048
Total .	3,049	3,534	3,099	2,592	3,061	3,137	3,403	3,353	3,670
Poultry .	668	792	984	840	741	901	943	1,036	1,189
Produce .	332	269	264	274	253	506	363	365	436

* Exclusive of Double Entries.

Shedding in Implement Yard (in Feet).

Description of Shedding.	Newcastle, 1935.	Ipswich, 1934.	Derby, 1933.	Southampton, 1932.	Warwick, 1931.	Manchester, 1930.	Harrogate, 1929.	Nottingham, 1928.	Newcastle, 1923.
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Ordinary .	1,760	2,240	2,095	1,845	2,190	2,690	2,995	3,035	4,280
Machinery	3,880	3,530	2,935	2,630	3,690	4,515	4,170	5,466	4,230
Special . (Seeds, Fertilizers, etc.)	3,071	3,176	3,360	2,450	3,083	3,488	3,686	3,501	3,392
Total . (Exclusive of Open Ground space.)	8,711	8,946	8,390	6,925	8,963	10,693	10,851	12,002	11,902
No. of Stands	356	387	349	311	388	443	431	467	453

Notwithstanding the particularly dry period in the early part of the year, the Flower Show at Newcastle was well up to its usual standard of excellence, and easily maintained its pride of place as the Royal's most popular and attractive "side-show." A special addition to this section was an exhibition, housed in a separate tent, of produce grown by members of local allotment-holders societies.

When the Show opened on the Tuesday morning the sky was overcast and there was some rain, but very soon the sun came through, and the great business of judging the live stock was carried through under perfect conditions. The attendance registered at the turnstiles—the largest first-day total for some fifteen years—proved a happy augury for the success of the

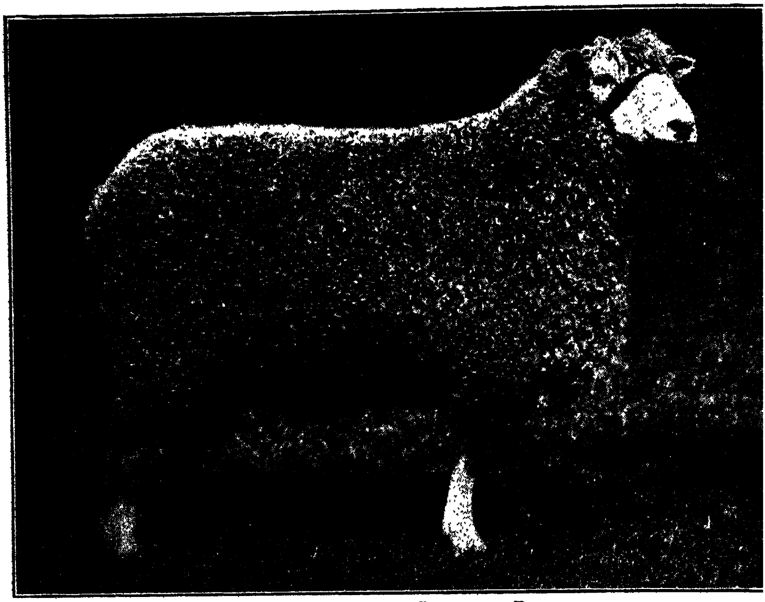


FIG. 7.—LEICESTER SHEARLING RAM.
Winner of Champion Prize for best exhibit of Leicester Sheep, Newcastle, 1935.
Exhibited by MR. R. MEGGINSON.

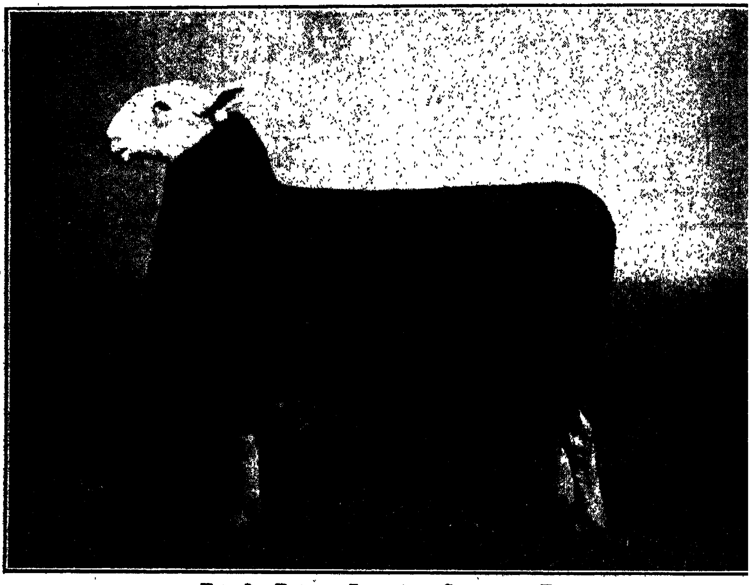


FIG. 8.—BORDER LEICESTER SHEARLING EWE.
Winner of Champion Prize for best Border Leicester Ram or Ewe, Newcastle, 1935.
Exhibited by MR. JOHN YOUNG.

Show generally. Amongst those present during the day were many visitors from different parts of the Empire and from foreign countries. The Minister of Agriculture and Fisheries, as well as the Agricultural Attachés of Colonial and foreign Governments, were present to see the judging. A party of 100 New Zealand farmers was also entertained at the Show on the Wednesday.

H.R.H. The Duke of Kent, the President, journeyed by air from London to Cramlington aerodrome on the Tuesday to be the guest of the Duke of Northumberland and his mother, the Duchess, at Alnwick Castle.

His Royal Highness paid his official visit to the Show on the Wednesday, which was again favoured with fine weather. Arriving about 11.30 a.m., the Royal party was met by the Honorary Director of the Show (Mr. Roland Burke) at the main entrance, and conducted through the Implement yard to the Royal Pavilion, where Members of the Council and the Local Committee were waiting to receive them.

During a tour of the showground His Royal Highness visited the Flower Show, the stands of the National Council of Social Service and the Rural Industries Bureau, the Agricultural Research and Education section, including the Clean Milk Production exhibit arranged by the Milk Marketing Board, the pavilion of the National Federation of Women's Institutes, the Forestry Exhibition, and the stand of the North Eastern Electric Supply Company. Later, he went into the Royal Box in the grand stand and spent some time witnessing events in the ring. These included the display of F (Sphinx) Battery of the Royal Horse Artillery, the judging of Heavy Draught Horse teams, and a parade of Pit Ponies, for which His Royal Highness presented the Champion Cup. He also saw Mr. Louis Priestman's Coach and the Braes of Derwent Foxhounds. Before leaving the showground, H.R.H. The President, in front of the Royal Pavilion, presented the Gold Challenge Cup to the successful competitors in the International Young Farmers' Dairy Cattle Judging Competition. This was won by the English team.

An air of pageantry was introduced this year by the daily parade in the ring of the Band of His Majesty's Coldstream Guards, a novelty applauded by the crowds gathered at the ring-side. The band parade was followed by the R.H.A. Musical Drive.

On the Thursday the weather continued fine, but there was a strong wind which caused some slight damage to canvas. In the course of the morning the exhibits in the Northumberland and Durham County classes were judged.

H.R.H. The Duke of Kent again attended the Show, arriving about 11 a.m. He went at once to the Large Tent, where he presided over the General Meeting of Governors and Members.

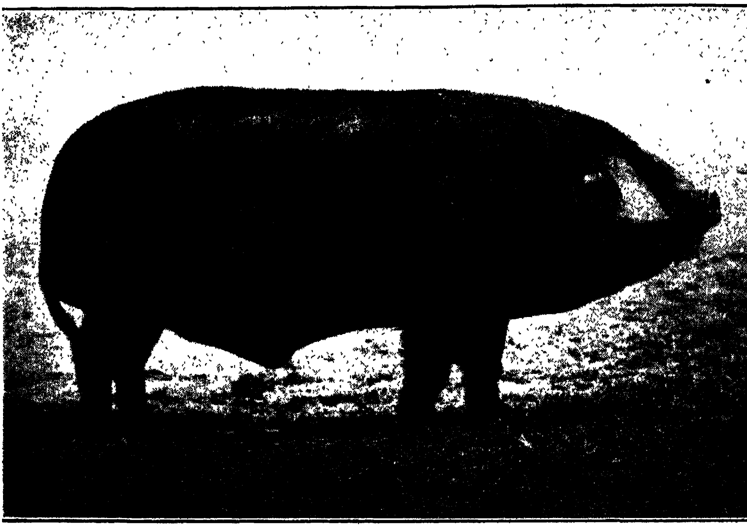


FIG. 9.—LARGE BLACK BOAR, "KEDINGTON ROYAL."
Winner of Champion Prize for best Large Black Boar, Newcastle, 1935.
Exhibited by MR. FRANK SAINSBURY.

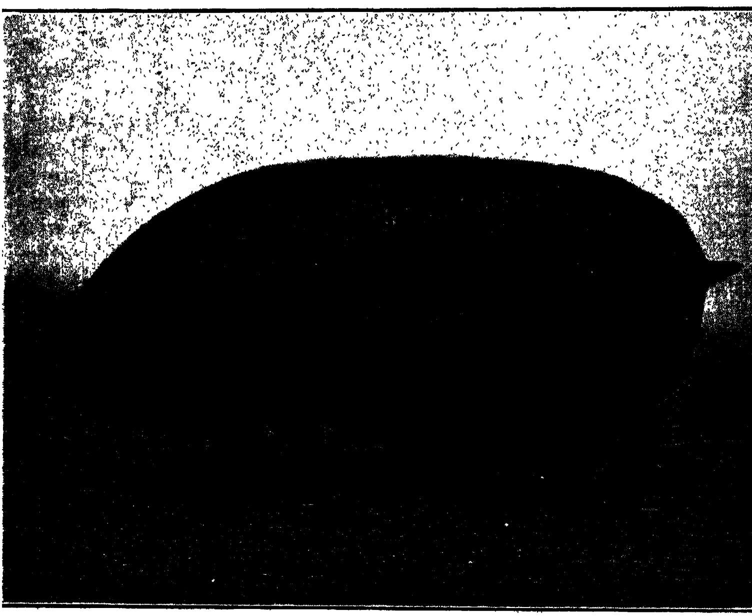


FIG. 10.—LARGE BLACK BREEDING SOW, "PAKENHAM ROSEMARY 3RD."
Winner of Champion Prize for the best Large Black Sow, Newcastle, 1935.
Exhibited by MR. D. W. P. GOUGH.

Votes of thanks were heartily accorded to the Lord Mayor and Corporation of Newcastle, the Local Committee, and the Committee and Stewards of the Freemen, for the great help they had severally given in connection with the Show.

Throughout the meeting the flapping of the canvas caused by the high wind, combined with the lowing of the Young Farmers' cattle exhibits, which were being judged in a ring close by, made it somewhat difficult for those at the back of the tent to follow the proceedings.

After the meeting the Duke of Kent left the Show to keep a luncheon engagement with the Newcastle Rotary Club. His Royal Highness returned south by air, leaving Cramlington at 5 p.m.

The following letter was subsequently received by Mr. Burke :

"Dear Mr. Roland Burke,

"I am desired by His Royal Highness the Duke of Kent to write and thank you for all the care and trouble that you took in making the arrangements for His Royal Highness's visit to the Royal Agricultural Society's Show at Newcastle.

"His Royal Highness was extremely interested in the Show, and much appreciated the way in which he was enabled to see the numerous exhibits.

"Yours sincerely,

"(*Signed*) John Lowther."

The Show on Friday opened with slight rain, but the sun appeared shortly before 10 o'clock and conditions remained fair for the rest of the day. The high wind displaced a portion of the canvas on one of the stands flanking the Horse Ring, but the damage was soon made good. An addition to the attractions on the last two days of the meeting was a Working Sheep Dog Demonstration by Mr. A. Telfer and his daughter.

An "extra turn" in the programme of ring events on the Saturday was a class for Mounted Police. Points taken into consideration by the judges were : the general turn-out of horse, rider and equipment, as well as the manners and general handiness of the horse for his duties. This competition attracted twenty-seven entries, the forces of seven different police authorities being represented.

Below will be found the detailed returns from the turnstiles at intervals on each day of the Show. To this is added a table giving comparative figures of the daily attendances at the six previous shows and the last Newcastle Meeting. The aggregate for the five days was, as might have been expected, well below that for 1923; it was, nevertheless, the largest attendance to be registered at any Show of the Society since that date.

Admissions by Payment at Newcastle.

Day of Show.	11 a.m.	1 p.m.	3 p.m.	5 p.m.	Day's Total.
Tuesday (5*s.*) .	2,359	3,870	4,894	5,161	5,246
Wednesday (5*s.*) . after 2 p.m. (3*s.*)	6,178	11,682*	21,669	25,233	25,985
Thursday (3*s.*) .	14,288	25,662	33,984	37,862	38,892
Friday (2*s.* 6*d.*) .	5,727	10,739	16,089	18,703	19,466
Saturday (1*s.*) .	7,144	15,905	32,632	42,656	43,931
Total for Show					133,520

* 2 p.m.

Total Daily Admissions at 1935 *Show compared with those at previous Six Shows and that at Newcastle in* 1923.

Day of Show.	Newcastle, 1935.	Ipswich, 1934.	Derby, 1933.	Southampton, 1932.	Warwick, 1931.	Manchester, 1930.	Harrogate, 1929.	Newcastle, 1923.
First .	5,246	4,823	3,171	1,116	1,887	2,483	3,884	3,587
Second .	25,985	23,137	21,684	8,165	11,273	14,352	23,598	37,926
Third .	38,892	37,628	26,981	11,686	24,198	31,115	51,252	63,183
Fourth .	19,466	21,165	13,573	11,997	15,193	14,943	18,924	42,457
Fifth .	43,931	20,248	30,941	14,614	19,708	38,025	26,359	39,357
	133,520	107,001	96,350	47,578	72,259	100,918	124,017	186,510

The surplus of receipts over expenditure was £6,505, but this has been reduced by a payment of £1,950 to the Local Committee to enable them to meet the cost of the preparation of the site and other obligations incurred in connection with the visit of the Show.

T. B. TURNER.

16, Bedford Square,
London, W.C.1.

REPORT ON NEW IMPLEMENTS ENTERED AT THE NEWCASTLE SHOW, 1935.

THE number of implements entered for the Society's Silver Medal was six.

The Consulting Engineer has placed at the disposal of the Judges detailed technical reports on them all, and the Judges have been given opportunity of making every desired observation on their design and working.

The standard of entries as a whole was not considered to be very high, and there was only one successful entry.

SUCCESSFUL ENTRY.

I. Tractor Hay Rake—Entered by Messrs. Blackstone & Co., Ltd., Stamford. Selling price £25.

This entry is a 40-tooth tipping hayrake specially adapted for use with a tractor or motor car. Its general construction is similar to that of the horse rake made by the same firm. It possesses the following new features :—

1. A hold-up device, by means of which the rake tooth frame can be caught by a stationary hook at the top of its tipping movement so that the teeth are suspended clear of the ground. The hook can be brought into or out of action by successive jerks on a cord controlled by the tractor driver.
2. In order to facilitate transport, the land wheels can be transferred to a transverse axle fitted across the middle of the rake frame. A special jack and stand are provided to enable this transfer to be made. At the same time, the main drawbar can be folded back and an auxiliary drawbar can be fixed to the end of the main axle. The overall travelling width of the implement can thus be reduced to 6 feet 6 inches.

The speed of carrying hay crops has been increased during recent years by the work of Hosier and other pioneers, and the particular interest aroused by Messrs. Blackstone's entry is in the possibilities of their rake when used in conjunction with large power sweeps.

Hosier demonstrated that by a great increase in sweeping speed it is possible at one loading to pick up more hay on a sweep of given area than on the same sweep at slower speed. The sweep principle being dependent to some extent on the inertia of the hay, the faster speed loads hay to a greater height over the area of the sweep. Thus the motor car sweep presented two

advantages, first of increased speed of travel and secondly of increased weight of hay per load.

The raking of hay before sweeping is desirable in that by placing the hay in thick rows at relatively wide intervals the sweep, in picking up, need traverse only the length of each row, leaving the raked ground between the rows unswept; but raked rows are also desirable in that, because of their height, the sweep is again able to increase the height of its load. Moreover, since the rake tends to pack the hay more closely together than, for example, a side delivery rake, the inertia of the mass is increased, and a fast moving sweep is able to pick up a larger cubic capacity of the more tightly packed hay.

The raking of hay before sweeping has, however, the disadvantage that the sweep, in taking advantage of the rake in respect of sweeping only the rows and not the ground in between them, must work across the direction in which the rake has worked; this means that if both rake and sweep are to work from fence to fence, the raking must be finished before the sweeping can begin.

With horse rakes this involves a loss of time and greater weather risks, which together are usually sufficient to discount the advantages of raking. The Blackstone tractor rake, however, in fields of a reasonable size, should have a capacity of 7 acres per hour, so that with it the disadvantage of raking is minimized.

For this reason it is the opinion of the Judges that this entry constitutes an appreciable advance in respect of increasing the speed of modern methods of carrying hay. It must be added that, once hay is fit for carrying, the one factor in saving it from weather risks is carrying speed.

The rake on test appeared to be a robust, easily handled implement, and no fault was found in the method of altering the position of the wheels to enable it to pass through gateways and along narrow roads.

DEFERRED ENTRIES.

I. Fishleigh Rotary Cultivator—Entered by The B. H. Brown Engineering Co., Ltd., Kenton Bank Foot, Newcastle-on-Tyne. Selling price £70—£90, according to width.

This is a rotary cultivator designed to be hauled by a tractor and to take its drive from a standard power take-off. The cultivator consists of a frame of steel channel carrying a rotor. The main shaft of the rotor carries steel tines arranged spirally along its length. The tines are supported by a cage, the bars of which take up shocks and prevent breakage. The frame is carried on two land wheels with cranked axles which are

adjustable for depth. The drive is taken from the power take-off of the tractor through a gearbox to a countershaft which carries an adjustable safety clutch. The final drive to the rotor is by single or double chain, according to the size of the implement. All the drives and the rotor are protected by covers and adequate lubrication facilities are provided.

From a constructional viewpoint, this machine has much to recommend it. It appears to be immune from tine choking and, as far as could be ascertained, from tine breakages. In comparison with some other forms of rotary cultivator, its cost is low in relation to its capacity. It is not rigidly attached to the tractor; thus manœuvring is easy, and since the cultivator is readily detached, the tractor is readily available for other purposes.

The following minor criticisms are offered :—

The machine would probably be improved by a widening of the tread of its wheels.

Occasionally the depression caused by the tractor wheels was not quite removed by the cultivator; this defect might be remedied by the fitting of slightly longer tines on the part of the cultivator which follows the wheel tracks of the tractor.

The entry is deferred because there were a number of questions on the subject of rotary tillage in general to which the Judges were not able to give unanimous answers.

1. Is rotary cultivation a physically correct and economical application of power ?

2. Subject to the answer to the first question being in the affirmative, the fact must be faced that there are two quite different forms of rotary tillage; one in which the tines are carried by a horizontal shaft—as in the case of this entry—and one in which the tines are carried by vertical shafts.

   Which of these constructions provides the desired result, or is there scope for both of them ?

3. If the machine does not provide a practicable means of arable cultivation, what is its value as a means of grass cultivation ?

The second question raises the point that the results of cultivation with the horizontal-shaft machines differ from those of cultivation with the vertical shaft machines much more than might at first sight be supposed.

The vertical-shaft machine leaves the soil in a relatively consolidated condition, so much so in some cases that the cultivated soil occupies no more space after cultivation than it did before—even when working on firm ground, such as a stubble which has not been stirred for some time.

The horizontal-shaft machine lifts the soil which it stirs, and usually leaves it in a much less consolidated condition—that is occupying much more space than it did before cultivation.

There would appear to be two consequences, viz :—

1. In the case of the horizontal-shaft machine, the subsequent crop, before the soil has settled to its consolidated level, has to root in soil of two different degrees of density—that of the stirred soil on the surface and that of the more firmly packed soil below the cultivation level. It is difficult to say whether both these conditions can provide a suitable medium for root development and plant feeding.
2. It seems reasonable, and would seem in practice to be true, that, in the cultivation of soils which have a tendency to run together, and become caked, the uniformly consolidated tilth of the vertical-shaft machine should suffer less from the detrimental effects of running together than the unconsolidated tilth which is characteristic of the horizontal-shaft machine.

The respective results on plant life of these two widely differing soil conditions can only be ascertained by observation, and it was considered that insufficient information was available to enable an opinion to be formed of the relative merits of the two systems.

In the event of horizontal-shaft rotary tillage being found unsuitable for drilled crops, its merits as a preparation for dibbling or plant setting form a further consideration. Here again more experience is required before a definite conclusion can be reached.

The Fishleigh Rotary Cultivator in use on grassland proved itself capable of producing a very severe cultivation. The opinions of two well-known grassland experts were considered by the Judges, and since these opinions were directly opposed to one another, the Judges found themselves no nearer to a decision.

It is hoped that, if and when this implement is entered again, more information will be available.

II. Motor Mowing Machine—Entered by Messrs. A. C. Bamlett, Ltd., Thirsk. Selling price £35 with 4 feet 6 inches cut.

This is an adaptation of a standard Bamlett mowing machine which enables a wide-cut mower to be drawn by a single horse. All gearing is eliminated and the drive is taken from a 2½ h.p. petrol engine fitted on a platform at the rear of the mower. The drive is by chain and sprocket to a fore-and-aft shaft which, at its forward end, carries the crank wheel which operates the pitman. As supplied for test, the mower had a 4 feet 6 inches

cut but, at the request of the farmer concerned, a 6 feet cutter bar was afterwards fitted.

The elimination of the standard transmission enables this machine to be sold at a price only a little higher than the 4 feet 6 inches horse machine without an engine.

It may not be an economical addition to the equipment of a large farm where modern tractors are available for use with power take-off tractor mowers, but it has great possibilities in application to smaller farms where grass is the chief interest and horses only are kept. On such farms hay harvest is likely to be a severe peak period in horse work, and the mower enables one horse to pull a 6 feet cut at a greater speed, and for a longer time daily, than two horses would be able to pull a 4 feet 6 inches cut machine. It is approximately correct to say that, in comparison with the standard mower, this implement will enable one horse to do the work of three. This alone is sufficient reason to justify the placing of the new Bamlett among mechanical developments which have contributed progress to efficient production. The labour saving implement which is of assistance at a peak period is rarely superfluous.

The entry was deferred because there were obvious improvements which it was thought the makers might add without difficulty.

The machine was shown working with a 6 feet cutter bar, but on a frame designed to carry a 4 feet 6 inches cutter bar, and accordingly with a narrow wheel track. The result was that the near side wheel was running on the last swath, with a tendency to pegging down of the crop, which must have resulted in waste and untidy raking or sweeping.

The wheels were of the standard type, with cast serrations on the treads. While these are necessary on horse machines without engines, for purposes of adhesion, they are only a source of needless vibration in the case of the power mower.

The position of the air-cooled engine (between the operator's legs) might prove a discomfort in hot weather.

A single horse is able to draw this machine at a brisk speed, and a safety device would be useful in the event of the cutter bar striking an obstruction.

In spite of these disadvantages, the entry, as shown, is a useful implement and should have a promising future, particularly with a little more attention to details of its design.

Unsuccessful Entries.

I. Hornsby-Leake Precision Drill—Entered by Messrs. Ransomes, Sims & Jefferies, Ltd., Ipswich.

The entry was deferred at the Ipswich Show, 1934, and was allowed to be re-entered in 1935.

Selling Price :—

12-row corn drill (as tested in 1934)	£69 0*s*. 0*d*.
Extra for fore-carriage steering	£8 10*s*. 0*d*.
Drill adapted for spaced drilling of root crops (as tested this year)	not stated.

Brief Description.

The novel feature of this drill is its feed mechanism, which is designed to give more even sowing. The following description of the feed as applied to a corn drill is taken from the Consulting Engineer's report for last year :—

"The mechanism for each pair of coulters consists of a cone which is carried on a vertical spindle inside a hopper placed immediately below the seed box. The cone is rotated by gearing from the land wheels and, in addition, is caused to oscillate vertically by means of a ratchet wheel. Seed passes from the seed box by gravity into the hopper, whence it is spun out in a steady stream into the corresponding seed tubes."

Trials of the drill in the field did not indicate that it deposited seed any more evenly than the best available cup-feed drill, although tests made when the drill was stationary indicated that the feed mechanism itself gave a more uniform flow of seed into the seed tube.

The Judges were of the opinion that any advantages that the feed mechanism might possess were destroyed in practice by the undue height from which the seed had to fall through the seed tubes. They therefore deferred the entry in order to give the manufacturers an opportunity of improving the performance of the drill by placing the feed mechanism closer to the ground.

The entry, as submitted for test this year, is a root drill. The recommendation of the Judges has been followed to the extent of placing a separate feed mechanism immediately on top of each coulter. Each feed cone is now separately driven by bevel gearing from a lay shaft which in turn takes a chain drive from the near-side land wheel, and there is a separate seed hopper for each coulter. At the same time, however, the drill has been adapted for spaced drilling by providing suitably spaced grooves or pockets around the lower edge of the feed cones. The effect of this modification is that the drill, as now entered, is not intended to deliver seed in a continuous row, but to deliver it in batches at regular intervals.

It will be appreciated that this drill was deferred at the 1934 Show because of its possibilities as a corn drill. The credit it received as such has not been consolidated by its entry at the 1935 Show as a spacing root drill, nor did an inspection of some

demonstration plots show it to be specially successful as a spacing drill. It has therefore been impossible for the Judges to make an award.

II. Track Laying Tractor—Entered by Bristol Tractors, Ltd., Willesden, London, N.W. Selling price £195.

The entry was deferred by the Judges of Implements at Ipswich and allowed to be re-entered in 1935.

Brief Description.

The following particulars are taken from the Consulting Engineer's Report for last year :—

"A track-laying type machine, having an overall width of 35½ inches and an overall length of 87 inches.

"The tracks are of the 'Roadless' rubber jointed type, giving 504 square inches ground contact, and are driven from the front sprocket. Steering is by differential and brakes. The tractor is fitted with a horizontally opposed twin cylinder, water-cooled petrol engine ; bore 3½ inches, stroke 4 inches, and is fitted with governor. The engine is rated at 10 h.p. on the drawbar and 12 h.p. on the belt when running at 2,000 r.p.m. The gearbox gives forward speeds of 1·64, 2·81 and 5·01 m.p.h. and a reverse speed of 1·45 m.p.h. at normal engine speed. A pulley running at 989 r.p.m. and a power take-off running at 519 r.p.m. are supplied as extras at a cost of £15 15*s.* 0*d.*

"Total weight in working order without operator: 2,296 lbs."

Results of Tests.

The Judges of Implements stated last year that they were satisfied with the test performance of this machine but required further evidence as to its "expectation of working life in relation to cost price."

In order to provide this evidence, enquiries were made of a number of owners of Bristol tractors, who were selected without reference to the entrants. The following questions were asked of each owner :—

1. How long had the tractor been in use?
2. Whether it was suitable for all types of general farm work, including two-furrow ploughing at medium depth.
3. Whether he considered the repair and replacement bill was likely to be heavy.
4. Whether, on the whole, he regarded the machine as a good investment for a small farm.

While the Judges appreciate that this track-laying tractor has good points and, being unique in size, is useful for certain hop and fruit cultivations, the answers to enquiries did not sufficiently satisfy them that it was worthy of an award.

III. Self Opening Gate—Entered by Mr. W. H. Bennett, Calthwaite, Penrith. Selling price, about £6 (not yet fixed).

The gate is made of two uprights connected by rails of wrought-iron pipe. The ends of the bottom rail extend beyond the uprights on either side and fit into bearings in the gate-posts so as to form pivots about which the gate can swing. The gate is secured in the upright position by latches which engage with the gate-posts and which are connected to a plate in the middle of the gate.

When the bumpers of a motor car or other vehicle are driven against this plate, the gate is unlatched automatically. The wheels of the car then push the gate flat on the ground and the car moves on over it with its wheels on suitably spaced metal tracks, which are bolted to the gate rails.

After the car has passed on, counter-weights or springs return the gate to the upright position, where it latches itself.

When it is necessary to drive a horse and cart or any kind of live stock through the gate, it is opened and pushed down by hand and is held in the horizontal position by a catch at ground level.

This entry was demonstrated to the Judges for the first time in the Show Yard. It was then in an experimental stage, and while a 2-ton lorry passed over it without apparent damage, it was clear that a vehicle of less robust construction might not do so. The gate itself was slightly damaged.

The Judges were unable to make an award.

D. R. Bomford.

Pitchill,
Evesham.

MILK YIELD AND BUTTER TEST TRIALS AT THE NEWCASTLE SHOW, 1935.

Owing to the sudden and regrettable death of Mr. William Burkitt in November last, the customary Report of the Steward of Dairying at the annual Show was not forthcoming. The usual Tables of points in the Tests are only therefore given, and follow on pp. 423–430.

Table I.—MILK YIELD CLASSES AT NEWCASTLE, 1935.

Catalogue No.	Exhibitor.	Name of Cow.	Date of Birth.	Date of last Calf.	No. of days in Milk.	Date of last Service.	Milk Yield. Morning.	Milk Yield. Noon.	Milk Yield. Evening.	Milk Yield. Total.	Average Fat percentage.	Points. Milk.	Points. Fat over 3 per cent. × 10.	Points. Lactation.	Points. Service.	Points. Total.	Awards and Remarks.
Class 225		Dairy Shorthorn. Thrice Milked.		1935		1935	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.							
1132	Fredk. Chapman	Blossom	Jan. 24, 1928	June 11	20	—	30 8	20 12	21 12	73 0	3·73	73·00	7·30	Nil	Nil	80·30	First Prize
1134	Dorman, Long & Co. Ltd.	Winter Rose 2nd	Jan. 16, 1928	April 14	78	—	18 4	16 0	13 4	47 8	3·43	47·50	4·30	3·80	Nil	55·60	Insufficient points
1135	J. Onslow Fane	Coleshill Foggathorpe 17th	Oct. 2, 1923	April 28	64	June 21	26 0	17 4	18 8	61 12	3·29	61·75	2·90	2·40	Nil	67·05	H.C.
1137	J. Pierpont Morgan	Aldenham Dot 6th	May 12, 1928	April 14	78	—	25 0	20 0	17 8	62 8	3·68	62·50	6·80	3·80	Nil	73·10	Reserve
1138	J. Pierpont Morgan	Aldenham Kirklevington Lady 3rd	Jan. 15, 1927	May 12	50	—	29 12	21 4	21 0	72 0	3·19	72·00	1·90	1·00	Nil	74·90	Third Prize
1142	Fredk. Chapman	Primrose Gift	Nov. 1, 1929	June 15	16	—	26 4	20 12	20 12	67 12	4·09	67·75	10·90	Nil	Nil	78·65	Second Prize
1151	Capt. Arnold S. Wills	Thornby Barrington Duchess 3rd	Dec. 23, 1929	April 21	71	—	21 12	14 12	17 4	53 12	3·29	53·75	2·90	3·10	Nil	59·75	H.C.
Class 226		Lincolnshire Red Shorthorn. Thrice Milked.															
1236	John Evens & Son	Bracebridge Lady	Feb. 5, 1928	June 8	23	—	22 8	18 4	17 4	58 0	3·42	58·00	4·20	Nil	Nil	62·20	Reserve
1237	John Evens & Son	Burton Recorder	April 6, 1930	May 25	37	—	23 8	14 4	14 8	52 4	2·97	52·25	Nil	Nil	Nil	52·25	Fat below standard
1238	John Evens & Son	Hainton Beauty 10th	Nov. 25, 1928	May 12	50	—	30 8	19 8	22 12	72 12	2·59	72·75	Nil	1·00	Nil	73·75	Fat below standard
1239	Frank Sainsbury	Wratting Cherry	Mar. 17, 1930	May 27	35	—	26 0	18 4	22 0	66 4	3·40	66·25	4·00	Nil	Nil	70·25	Second Prize
1240	Scothern Dairy Co.	Lobthorpe Princess	Feb. , 1929	May 6	56	—	33 8	28 4	26 4	88 0	2·85	88·00	Nil	1·60	Nil	89·60	Fat below standard
1243	Russell Wood	Bendish Nancy 18th	Nov. 12, 1929	May 13	49	—	25 8	20 0	18 12	64 4	3·63	64·25	6·30	·90	Nil	71·45	First Prize
1244	Russell Wood	Bendish Woodland Rose 6th	May 21, 1927	June 11	20	—	25 4	17 0	19 4	61 8	3·19	61·50	1·90	Nil	Nil	63·40	Third Prize
Class 228		Red Poll. Thrice Milked.															
1299	Lord Cranworth	Grundisburgh Good Duck	July 22, 1929	May 12	50	—	21 0	17 8	16 12	55 4	3·96	55·25	9·60	1·00	Nil	65·85	Third Prize
1302	Mrs. R. M. Foot	White Hill Fair Flirt	Aug. 13, 1928	June 7	24	—	32 4	23 4	24 0	79 8	2·64	79·50	Nil	Nil	Nil	79·50	Fat below standard
1304	J. G. Gray	Whiteway Welcome	Nov. 27, 1924	Mar. 12	111	May 18	23 4	16 4	16 0	55 8	3·10	55·50	1·00	7·10	.40	64·00	H.C.
1308	Stuart Paul	Model Victoria	Oct. 6, 1923	June 1	30	—	27 0	23 0	21 0	71 0	4·28	71·00	12·80	Nil	Nil	83·80	First Prize
1312	Sir Woodman Burbidge, Bt.	Knepp Primula 3rd	April 20, 1930	May 16	46	—	14 12	9 0	12 4	36 0	3·52	36·00	5·20	·60	Nil	41·80	Insufficient points
1314	C. H. Cearn	Abbeycombe Fatsia	Feb. 20, 1930	June 15	16	—	22 12	15 0	15 8	53 4	4·23	53·25	12·30	Nil	Nil	65·55	Reserve
1322	Edward Hinchliffe	Uttringham Violet	June 19, 1930	May 30	32	—	31 0	19 12	17 4	68 0	3·43	68·00	4·30	Nil	Nil	72·30	Second Prize
1323	Mrs. Henry D. Lewis	Cleeter Rita	Jan. 3, 1932	June 17	14	—	14 8	9 8	9 12	33 12	3·46	33·75	4·60	Nil	Nil	38·35	Insufficient points
Class 228		Red Poll. Twice Milked.															
1295	H.M. The King	Norton Daffodil	Sept. 18, 1923	June 9	22	—	28 12	—	29 12	58 8	3·41	58·50	4·10	Nil	Nil	62·60	H.C.
1315	Sir H. E. de Trafford, Bt.	Longwood Christabel 6th	Nov. 19, 1930	May 22	40	June 14	17 0	—	18 0	35 0	2·82	35·00	Nil	Nil	Nil	35·00	Insufficient points
1327	James Younger	Burradon Dawn 4th	April 6, 1930	May 3	59	—	22 4	—	22 8	44 12	3·28	44·75	2·80	1·90	Nil	49·45	Insufficient points
Class 229		Blue Albion. Thrice Milked.															
1362	C. H. Webster	Ivonbrook Amy	Mar. 3, 1931	June 10	21	—	12 4	10 4	10 12	33 4	5·64	33·25	26·40	Nil	Nil	59·65	First Prize

MILK YIELD CLASSES AT NEWCASTLE, 1935 (*continued*).

Catalogue No.	Exhibitor.	Name of Cow.	Date of Birth.	Date of last Calf.	No. of days in Milk.	Date of last Service.	Milk Yield. Morning.	Milk Yield. Noon.	Milk Yield. Evening.	Milk Yield. Total.	Average Fat percentage.	Points. Milk.	Points. Fat over 3 per cent. × 10.	Points. Lactation.	Points. Service.	Points. Total.	Awards and Remarks.
Class 229		Blue Albion. Twice Milked.		1935		1935	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.							
1358	T. H. Calderbank . .	Stow Doreen	Jan. 6, 1932	May 1	61	—	22 0	—	26 4	48 4	2·43	48·25	Nil	2·10	Nil	50·35	Fat below standard
1359	W. E. Glover . . .	Mount Crocus 3rd	Aug. 11, 1929	May 2	60	—	23 4	—	25 12	49 0	3·60	49·00	6·00	2·00	Nil	57·00	Second Prize
1360	W. E. Glover . . .	Patience of Snarestone . . .	— 1931	June 21	10	—	20 0	—	21 8	41 8	5·67	41·50	26·70	Nil	Nil	68·20	Ineligible. Calved after June 18
Class 230		British Friesian. Thrice Milked.															
1423	Cecil Ball	Oakham Dairymaid	Mar. 17, 1929	June 8	23	—	36 0	28 8	25 8	90 0	3·47	90·00	4·70	Nil	Nil	94·70	Second Prize
1424	Arthur Barber . . .	Whaley Lavender	Nov. 27, 1924	June 1	30	—	36 8	25 4	29 4	91 0	3·09	91·00	·90	Nil	Nil	91·90	Third Prize
1426	T. B. Gladstone . .	Dignit Fairy	Dec. 8, 1928	June 5	26	—	31 12	21 4	22 0	75 0	3·33	75·00	3·30	Nil	Nil	78·30	H.C.
1430	Lord Rayleigh . . .	Terling Breeze 34th	Feb. 21, 1929	May 23	39	—	35 0	35 4	27 0	97 4	2·10	97·25	Nil	Nil	Nil	97·25	Fat below standard
1431	Lord Rayleigh . . .	Terling Dazzle 17th	Nov. 17, 1927	June 8	28	—	43 8	30 4	30 8	104 4	2·89	104·25	Nil	Nil	Nil	104·25	Fat below standard
1432	Lord Rayleigh . . .	Terling Ivory 16th	Mar. 15, 1927	May 28	34	—	37 12	28 4	27 0	93 0	3·38	93·00	3·80	Nil	Nil	96·80	First Prize
1433	Lord Rayleigh . . .	Terling Thyme 17th	Aug. 12, 1929	June 10	21	—	29 0	24 4	24 0	77 4	3·14	77·25	1·40	Nil	Nil	78·65	Reserve
1436	A. Weightman . . .	Golf Birthday Sands	Nov. 18, 1927	May 27	35	—	25 8	20 0	18 8	64 0	2·83	64·00	Nil	Nil	Nil	64·00	Fat below standard
Class 231		Ayrshire. Thrice Milked.															
1501	Capt. W. B. Dronsfield	Knowe Orange Blossom . . .	Dec. 4, 1925	May 31	31	—	23 8	18 0	19 0	60 8	3·53	60·50	5·30	Nil	Nil	65·80	Reserve
1518	A. D. & J. Murchie .	Bogside Butter Fat	Feb. 19, 1929	June 14	17	—	27 4	18 12	19 8	65 8	3·72	65·50	7·20	Nil	Nil	72·70	First Prize
1521	D. H. Sanderson . .	Newlands Acorn	Nov. 23, 1921	June 9	22	—	26 4	23 4	21 0	70 8	3·14	70·50	1·40	Nil	Nil	71·90	Second Prize
1525	William Wilson . .	Thornhill Morag 2nd	Mar. 7, 1929	June 13	18	—	22 8	16 0	16 4	54 12	4·15	54·75	11·50	Nil	Nil	66·25	Third Prize
Class 232		Guernsey. Thrice Milked.															
1581	Capt. Cosmo Douglas .	Hazelby Sunshine	Feb. 17, 1928	May 17	45	—	21 8	16 4	15 0	52 12	3·97	52·75	9·70	·50	Nil	62·95	H.C.
1586	G. W. Greenshields .	Harrington Bridesmaid . . .	April 28, 1928	June 16	15	—	21 0	15 12	15 4	52 0	5·65	52·00	26·50	Nil	Nil	78·50	Second Prize
1589	Carl Holmes . . .	Dairy Queen of Clover Top . .	Nov. 3, 1929	Mar. 27	96	—	25 8	18 0	17 4	60 12	4·29	60·75	12·90	5·60	Nil	79·25	First Prize
1590	Carl Holmes . . .	Dairy Queen 2nd of Clover Top .	Dec. 28, 1930	Jan. 15	157	May 14	18 12	13 8	12 8	44 12	3·56	44·75	5·60	12·00	·80	63·15	H.C.
1591	Carl Holmes . . .	May Rose of Clover Top . .	Aug. 2, 1929	April 23	69	—	23 4	15 12	16 4	55 4	4·15	55·25	11·50	2·90	Nil	69·65	Fourth Prize
1593	Lord Swaythling . .	De Bangy's Midget 5th . . .	Aug. 14, 1930	June 2	29	—	23 0	18 12	20 12	62 8	3·37	62·50	3·70	Nil	Nil	66·20	Fifth Prize
1595	Capt. Cosmo Douglas .	Hazelby Honoria	May 4, 1931	June 10	21	—	28 0	24 12	23 4	76 0	2·97	76·00	Nil	Nil	Nil	76·00	Fat below standard
1605	Capt. Frank Schwab .	Kingfield Rosey's Primrose . .	April 17, 1931	Jan. 10	172	April 13	14 12	10 12	10 4	35 12	3·72	35·75	7·20	12·00	3·90	58·85	H.C.
1606	Capt. Frank Schwab .	Kingfield Valentine	Feb. 20, 1931	Mar. 29	94	—	18 0	13 0	11 4	42 4	3·70	42·25	7·00	5·40	Nil	54·65	H.C.
1607	Lord Swaythling . .	Bladen Gay Lass 2nd . . .	May 15, 1932	Nov. 19, 1934	224	April 14	21 4	14 8	13 8	49 4	3·00	49·25	Nil	12·00	3·80	65·05	Reserve
1609	Mrs. Yorke	Peter's Jennette	Dec. 28, 1931	June 10	21	—	22 0	16 12	19 4	58 0	5·01	58·00	20·10	Nil	Nil	78·10	Third Prize
Class 233		Guernsey. Twice Milked.															
1608	Mr. & Mrs. E. E. Thornton	Aethol 2nd of the Simons . .	Mar. 25, 1931	April 30	62	—	18 8	—	26 0	44 8	3·83	44·50	8·30	2·20	Nil	55·00	H.C.

MILK YIELD CLASSES AT NEWCASTLE, 1935 (*continued*).

Catalogue No.	Exhibitor.	Name of Cow.	Date of Birth.	Date of last Calf.	No. of days in Milk.	Date of last Service.	Milk Yield. Morning.	Milk Yield. Noon.	Milk Yield. Evening.	Milk Yield. Total.	Average Fat percentage.	Points. Milk.	Points. Fat over 3 per cent. × 10.	Points. Lactation.	Points. Service.	Points. Total.	Awards and Remarks
				1935		1935	Lb. oz.	Lb. oz.	Lb. oz.	Lb. oz.							
Class 233		**Jersey. Thrice Milked.**															
1662	Mrs. G. J. Caddey	Precious Bane	June 6, 1930	June 13	18	—	20 0	19 0	18 0	57 0	4·16	57·00	11·60	Nil	Nil	68·60	Fifth Prize
1667	Sir John B. Lloyd	Dreaming Fleckie Lass	May 31, 1930	April 15	77	—	14 0	13 4	13 0	40 4	4·09	40·25	10·90	3·70	Nil	54·85	H.C.
1669	S. S. Lockwood	Stonehurst Patrician's Sepia	April 2, 1928	June 10	21	—	21 4	17 8	16 12	55 8	4·36	55·50	13·60	Nil	Nil	69·10	Fourth Prize
1670	J. W. McCallum	Highsteads Viscountess	May 1, 1929	April 22	70	June 24	21 4	14 0	16 8	51 12	4·28	51·75	12·80	3·00	Nil	67·55	H.C.
1672	Sir Harold Mackintosh, Bt.	Golden Bessie	May 11, 1931	May 29	33	—	25 8	19 4	18 8	63 4	3·64	63·25	6·40	Nil	Nil	69·65	Third Prize
1674	Sir Harold Mackintosh, Bt.	Wonderful Peggy	Mar. 25, 1931	Feb. 6	145	June 8	18 0	12 12	10 12	41 8	5·03	41·50	20·30	10·50	Nil	72·30	Second Prize
1682	Colin S. Richardson	Wheelbirks Cornelia	Oct. 21, 1927	May 25	37	—	23 0	18 0	19 0	60 0	4·72	60·00	17·20	Nil	Nil	77·20	First Prize
Class 233		**Jersey. Twice Milked.**															
1663	Mrs. Henry Hawkins	Jim's Queen of Spades	Mar. 30, 1928	Mar. 28	95	June 9	25 8	—	22 0	47 8	3·79	47·50	7·90	5·50	Nil	60·90	H.C.
1664	Mrs. Henry Hawkins	Tachi	June 27, 1926	April 8	84	June 12	24 8	—	23 0	47 8	4·11	47·50	11·10	4·40	Nil	63·00	H.C.
1675	M. F. North	Gracious Lady	June 5, 1928	April 28	64	—	29 0	—	28 8	57 8	3·85	57·50	8·50	2·40	Nil	68.40	Reserve
1676	M. F. North	Snowball	Nov. 12, 1925	May 9	53	—	27 0	—	27 0	54 0	4·20	54·00	12·00	1·30	Nil	67.30	H.C.
1681	Wm. E. Press	Miss Bayard's Tulip 2nd	May 24, 1927	Mar. 12	111	—	17 4	—	18 0	35 4	4·80	35·25	18·00	7·10	Nil	60.35	H.C.
1695	Hon. Mrs. Tennant	Wonderful Countess	June 5, 1932	April 14	78	June 27	18 0	—	19 12	37 12	3·91	37·75	9·10	3·80	Nil	50·65	H.C.
Class 234		**Kerry. Thrice Milked.**															
1737	Lt.-Col. J. A. Innes, D.S.O.	Ard Cacin Doe	Dec. 23, 1930	May 11	51	—	14 4	11 0	10 12	36 0	5·02	36·00	20·20	1·10	Nil	57·30	Third Prize
1738	Kerry Cow Dairy Farms	Drumgaunagh Babelle	Mar. 1, 1927	Dec. 23, 1934	190	May 5	9 12	6 8	6 12	23 0	3·17	23·00	1·70	12·00	1·70	38·40	Insufficient points
1739	H. E. Mitchell	Cuckfield Pearl	May 20, 1925	June 9	22	—	18 0	12 8	12 12	43 4	4·43	43·25	14·30	Nil	Nil	57·55	Second Prize. Res. "Elmhurst Cup"
1740	Newton R. Steel	Algernon Best-of-All	May 18, 1924	May 27	85	—	8 0	5 4	5 4	18 8	2·68	18·50	Nil	Nil	Nil	18·50	Fat below standard
1742	Newton R. Steel	Pallas Victoria	Mar. 8, 1924	April 18	74	—	23 0	16 8	15 4	54 12	3·47	54·75	4·70	3·40	Nil	62·85	First Prize. "Elmhurst Cup."
Class 235		**Dexter. Thrice Milked.**															
1754	Mrs. Ernest Johnson	Ashtonhayes Woodlawn	Feb. 14, 1931	May 3	59	June 3	19 4	12 8	12 12	44 8	3·26	44·50	2·60	1·90	Nil	49·00	Second Prize. Res. D.C.S. Cup
1757	Mrs. T. H. Peyton	Thorp Dora	Feb. 6, 1928	May 5	57	—	19 12	14 12	13 12	48 4	3·12	48·25	1·20	1·70	Nil	51·15	First Prize. D.C.S. Cup
Class 235		**Dexter. Twice Milked.**															
1755	Miss N. M. Lloyd	Pentre Hobyn Jasmine	April 29, 1927	April 7	85	—	20 12	—	18 4	39 0	2·87	39·00	Nil	4·50	Nil	43·50	Fat below standard
1756	Mrs. T. H. Payton	Colomendy Gay	May 23, 1927	April 19	78	—	19 4	—	17 8	36 12	3·26	36·75	2·60	3·30	Nil	42·65	Third Prize

Average Result in Milk Yield Classes.

No of Cows competing.	Breed.	Days in Milk.	Yield of Milk.		Fat percentage.	Total Points.
			lb.	oz.		
7	Dairy Shorthorn . . .	53·86	62	10	3·53	69·91
7	Lincolnshire Red Shorthorn	38·57	66	2	3·15	68·99
11	Red Poll . . .	40·36	53	11	3·47	59·84
4	Blue Albion . . .	38·00	43	0	4·33	58·80
8	British Friesian . .	28·88	86	7	3·03	88·23
4	Ayrshire	22·00	62	13	3·64	69·16
12	Guernsey . . .	84·58	52	13	3·93	67·28
13	Jersey	68·15	49	14	4·23	65·37
5	Kerry	74·40	35	2	3·75	46·92
4	Dexter	68·50	42	2	3·13	46·58

Average Result of Breeds entered in Butter Test.

No. of Cows competing.	Breed.	Days in Milk.	Yield of Milk.		Yield of Butter.		Butter ratio in lbs.	Points.
			lb.	oz.	lb.	oz.		
10	Guernsey . .	97·90	52	6	1	14½	28·04	44·56
13	Jersey . .	68·15	49	14½	2	3½	22·78	46·40
1	Kerry . . .	22·00	43	4	2	0	21·62	39·00
4	Dairy Shorthorn .	44·50	66	4	2	5½	28·78	44·30
6	Lincoln Red Shorthorn .	35·67	62	8	1	12	36·27	32·90
4	Red Poll . .	48·75	51	3	1	8	34·56	29·28
7	British Friesian .	29·29	88	1½	2	7½	36·80	43·39
2	Ayrshire . .	26·50	65	8	1	13½	36·58	34·25
1	Blue Albion . .	60·00	49	0	2	12½	17·62	54·50

TABLE V.—RESULTS OF BUTTER TESTS AT NEWCASTLE, 1935.

CLASS 236.—COWS OF GUERNSEY, JERSEY, KERRY OR DEXTER BREEDS.

No. in Catalogue	Exhibitor.	Name of Cow.	Date of Birth.	Date of last Calf.	No. of Days in Milk.	Date of last Service	Milk Yield in 24 hours.	Butter Yield.	Ratio, viz. lb. milk to lb Butter.	No. of Points for Butter.	No. of Points for Lactation.	No. of Points for Service.	No. of Points for Quality of Butter	Total No. of Points.	Awards and Remarks.
		Guernsey. Thrice milked.		1935			Lb. oz.	Lb. oz.							
1581	Capt. Cosmo Douglas.	Hazelby Sunshine	Feb. 17, 1928	May 17	45	—	52 12	2 1¼	25·19	33·50	·50	—	10·00	44·00	H.C. and E.G.C.S., Cert. of Merit.
1589	Carl Holmes	Dairy Queen of Clover Top	Nov. 3, 1929	Mar. 27	96	—	60 12	2 13	21·60	45·00	5·60	—	8·00	58·60	First Prize. Reserve for Champion Gold Medal.
1590	Carl Holmes	Dairy Queen 2nd of Clover Top	Dec. 23, 1930	Jan. 15	167	May 14	44 12	1 7½	30·47	23·50	12·00	·80	10·00	46·30	Ratio over 30.
1591	Carl Holmes	May Rose of Clover Top	Aug. 2, 1929	April 23	69	—	55 4	2 4	24·56	36·00	2·90	—	8·00	46·90	H.C. and E.G.C.S., Cert. of Merit.
1593	Lord Swaythling	De Baugy's Midget 5th	Aug. 14, 1930	June 2	29	—	62 8	1 13¾	33·90	29·50	—	—	7·00	36·50	Ratio over 30.
1596	Capt. Cosmo Douglas	Hazelby Honoria	May 4, 1931	June 10	21	—	76 0	2 2	35·76	34·00	—	—	6·00	40·00	Ratio over 30.
1605	Capt. Frank Schwab	Kingfield Rosey's Primrose	April 17, 1931	Jan. 10	172	April 13	35 12	1 5	27·23	21·00	12·00	3·90	8·00	44·90	H.C. and E.G.C.S., Cert. of Merit.
1606	Capt. Frank Schwab	Kingfield Valentine	Feb. 20, 1931	Mar. 29	94	—	42 4	1 8¼	27·59	24·50	5·40	—	7·00	36·90	Insufficient points.
1607	Lord Swaythling	Bladen Gay Lass 2nd	May 15, 1932	Nov. 19, 1934	224	April 14	49 4	1 11¼	28·05	27·50	12·00	3·80	8·00	51·30	Fourth Prize.
		Guernsey. Twice milked.													
1608	Mr. and Mrs. E. E. Thornton	Aethol 2nd of the Simons	Mar. 25, 1931	April 30	62	—	44 8	1 12	25·43	28·00	2·20	—	10·00	40·20	H.C.
		Jersey. Thrice milked.													
1662	Mrs. G. J. Caddey	Precious Bane	June 6, 1930	June 18	18	—	57 0	2 9	22·24	41·00	—	—	10·00	51·00	Reserve E.J.C.S., Cert. of Merit.
1667	Sir John B. Lloyd	Dreaming Fleckie Lass	May 31, 1930	April 15	77	—	40 4	1 9	24·77	25·00	3·70	—	5·00	33·70	Insufficient points.
1669	S. S. Lockwood	Stonehurst Patrician's Sepia	April 2, 1928	June 10	21	—	55 8	2 8¼	21·93	40·50	—	—	8·00	48·50	H.C. and E.J.C.S., Cert. of Merit.
1670	J. W. McCallum	Highsteads Viscountess	May 1, 1929	April 22	70	June 24	51 12	2 5	22·38	37·00	3·00	—	9·00	49·00	H.C. and E.J.C.S., Cert. of Merit.
1672	Sir Harold Mackintosh, Bart.	Golden Bessie	May 11, 1931	May 29	33	—	63 4	2 0¼	31·14	32·50	—	—	8·00	40·50	Ratio over 30.
1674	Sir Harold Mackintosh, Bart.	Wonderful Peggy	Mar. 25, 1931	Feb. 6	145	June 8	41 8	2 4¼	18·19	36·50	10·50	—	8·00	55·00	Third Prize, E.J.C.S. Silver Medal
1675	M. F. North	Gracious Lady	June 5, 1928	April 28	64	—	57 8	2 7¼	23·29	39·50	2·40	—	8·00	49·90	H.C. and E.J.C.S. Cert. of Merit.
1676	M. F. North	Snowball	Nov. 12, 1925	May 9	53	—	54 0	2 9	21·07	41·00	1·30	—	9·00	51·30	Fifth Prize, E.J.C.S. Bronze Medal.

TABLE V.—RESULTS OF BUTTER TESTS AT NEWCASTLE, 1935.

CLASS 236.—COWS OF GUERNSEY, JERSEY, KERRY OR DEXTER BREEDS—*Continued.*

No. in Catalogue	Exhibitor.	Name of Cow.	Date of Birth.	Date of last Calf.	No. of Days in Milk.	Date of last Service	Milk Yield in 24 hours.	Butter Yield.	Ratio, viz. lb. milk to lb Butter.	No. of Points for Butter.	No. of Points for Lactation.	No. of Points for Service.	No. of Points for Quality of Butter	Total No. of Points.	Awards and Remarks.
		Jersey. Thrice milked.		1935			Lb. oz.	Lb. oz.							
1681	William E. Press	Miss Bayard's Tulip 2nd	May 24, 1927	Mar. 12	111	—	35 4	1 12	20·14	28·00	7·10	—	8·00	43·10	H.C. and E.J.C.S. Cert. of Merit.
1682	Colin S. Richardson	Wheelbirks Cornelia	Oct. 21, 1927	May 23	87	—	60 0	2 15½	20·21	47·50	—	—	9·00	56·50	Second Prize. E.J.C.S. Gold Med.
		Jersey. Twice milked.													
1683	Mrs. Henry Hawkins	Jim's Queen of Spades	Mar. 30, 1928	Mar. 28	95	June 9	47 8	1 14½	24·92	30·50	5·50	—	10·00	46·00	H.C. and E.J.C.S. Cert. of Merit.
1684	Mrs. Henry Hawkins	Tachi	June 27, 1926	April 8	84	June 12	47 8	2 1½	22·69	33·50	4·40	—	9·00	46·90	H.C. and E.J.C.S. Cert. of Merit.
1695	Hon. Mrs. Tennant	Wonderful Countess	June 5, 1932	April 14	78	June 27	37 12	1 10	23·23	26·00	3·80	—	2·00	31·80	—
		Kerry. Thrice milked.													
1739	H. E. Mitchell	Cuckfield Pearl	May 20, 1925	June 9	22	—	43 4	2 0	21·62	32·00	—	—	7·00	39·00	H.C.

CLASS 237.—COW OF ANY BREED OTHER THAN THOSE MENTIONED IN CLASS 236.

No. in Catalogue	Exhibitor.	Name of Cow.	Date of Birth.	Date of last Calf.	No. of Days in Milk.	Date of last Service	Milk Yield in 24 hours.	Butter Yield.	Ratio, viz. lb. milk to lb Butter.	No. of Points for Butter.	No. of Points for Lactation.	No. of Points for Service.	No. of Points for Quality of Butter	Total No. of Points.	Awards and Remarks.
		Dairy Shorthorn. Thrice milked.													
1132	Frederick Chapman	Blossom	Jan. 24, 1928	June 11	20	—	73 0	2 3½	32·90	35·50	00·00	—	4·00	39·50	Ratio over 30.
1135	J. Onslow Fane	Coleshill Foggathorpe 17th	Oct. 2, 1923	April 28	64	June 21	61 12	1 15	31·87	31·00	2·40	—	4·00	37·40	Ratio over 30.
1137	J. Pierpont Morgan	Aldenham Dot 6th	May 12, 1928	April 14	78	—	62 8	2 5	27·03	37·00	3·80	—	6·00	46·80	Fourth Prize.
1143	Frederick Chapman	Primrose Gift	Nov. 1, 1929	June 15	16	—	67 12	2 14½	23·31	46·50	—	—	7·00	53·50	Third Prize.
		Lincolnshire Red Shorthorn. Thrice milked.													
1236	John Evens & Son	Bracebridge Lady	Feb. 5, 1928	June 8	23	—	58 0	1 8½	37·88	24·50	—	—	3·00	27·50	Ratio over 30.
1237	John Evens & Son	Burton Recorder	April 6, 1930	May 25	37	—	52 4	1 8½	34·12	24·50	—	—	4·00	28·50	Ratio over 30.
1238	John Evens & Son	Hainton Beauty 10th	Nov. 25, 1928	May 12	50	—	72 12	1 7½	49·53	23·50	1·00	—	5·00	29·50	Ratio over 30.
1239	Frank Sainsbury	Wratting Cherry	Mar. 17, 1930	May 27	35	—	66 4	2 2	31·18	34·00	—	—	4·00	38·00	Ratio over 30.
1243	Russell Wood	Bendish Nancy 18th	Nov. 12, 1929	May 13	49	—	64 4	2 0	32·13	32·00	·90	—	5·00	37·90	Ratio over 30.
1244	Russell Wood	Bendish Woodlands Rose 6th	May 21, 1927	June 11	20	—	61 8	1 14	32·80	30·00	—	—	6·00	36·00	Ratio over 30.

TABLE V.—RESULTS OF BUTTER TESTS AT NEWCASTLE, 1935,

CLASS 237.—COW OF ANY BREED OTHER THAN THOSE MENTIONED IN CLASS 236.—*Continued.*

		Red Poll. Thrice milked.		1935			Lb. oz.	Lb. oz.							
1302	Mrs. R. M. Foot	White Hill Fair Flirt	Aug. 13, 1928	June 7	24	—	79 8	2 1¼	37·97	33·50	—	—	2·00	35·50	Ratio over 30.
1304	J. G. Gray	Whiteway Welcome	Nov. 27, 1924	Mar. 12	111	May 18	55 8	1 13	30·62	29·00	7·10	·40	3·00	39·50	Ratio over 30.
1318	Sir Woodman Burbidge, Bart.	Knepp Primula 3rd	April 20, 1930	May 16	46	—	36 0	1 4½	28·09	20·50	·60	—	5·00	26·10	Insufficient points.
1328	Mrs. Henry D. Lewis	Ciceter Rita	Jan. 3, 1932	June 17	14	—	33 12	0 13	41·54	13·00	—	—	3·00	16·00	Ratio over 30.
		Blue Albion. Twice Milked.													
1359	W. H. Glover	Mount Crocus 3rd	Aug. 11, 1929	May 2	60	—	49 0	2 12¼	17·62	44·50	2·00	—	8·00	54·50	Second Prize.
		British Friesian. Thrice milked.													
1423	Cecil Ball	Oakham Dairymaid	Mar. 17, 1929	June 8	28	—	90 0	3 8½	27·96	51·50	—	—	9·00	60·50	First Prize, Champion Gold Medal.
1424	Arthur Barber	Whaley Lavender	Nov. 27, 1924	June 1	30	—	91 0	2 11	33·86	43·00	—	—	4·00	47·00	Ratio over 30.
1430	Lord Rayleigh	Terling Breeze 34th	Feb. 21, 1929	May 23	39	—	97 4	1 12¼	54·59	28·50	—	—	2·00	30·50	Ratio over 30.
1431	Lord Rayleigh	Terling Dazzle 17th	Nov. 17, 1927	June 8	23	—	104 4	2 15	35·49	47·00	—	—	3·00	50·00	Ratio over 30.
1432	Lord Rayleigh	Terling Ivory 16th	Mar. 15, 1927	May 28	34	—	93 0	2 10¼	35·01	42·50	—	—	3·00	45·50	Ratio over 30.
1433	Lord Rayleigh	Terling Thyme 17th	Aug. 12, 1929	June 10	21	—	77 4	2 7	31·69	39·00	—	—	2·00	41·00	Ratio over 30.
1436	Albert Weightman	Golf Birthday Sands	Nov. 23, 1927	May 27	35	—	64 0	1 10¼	39·01	26·25	—	—	3·00	29·25	Ratio over 30.
		Ayrshire. Thrice milked.													
1501	Capt. W. B. Dronsfield	Knowe Orange Blossom	Dec. 4, 1925	May 31	31	—	60 8	2 0¼	29·78	32·50	—	—	4·00	36·50	Insufficient points.
1521	D. H. Sanderson	Newlands Acorn	Nov. 23, 1921	June 9	22	—	70 8	1 10	43·38	26·00	—	—	6·00	32·00	Ratio over 30.

TABLE VI.—MILK YIELD CLASSES FOR GOATS AT NEWCASTLE, 1935.

CLASS 250.—QUALITY.

No. in Catalogue.	Exhibitor.	Name of Goat.	Breed.	Date of Birth.	Date of last Kid.	No. of days in Milk.	Milk Yield. Morn.	Milk Yield. Even.	Milk Yield. Total	Percentage of Fat. Morn.	Percentage of Fat. Even.	Points. Milk.	Points. Fat.	Points. Lactation.	Points. Total.	Points. Deduction.	Points. Net Total.	Awards and Remarks.
							Lb. oz.	Lb. oz.	Lb. oz.									
1763	Miss M. Henderson	Riding Chloe	Toggenburg	Feb. 7, 1932	Feb. 8, 1935	145	4 0	3 11	7 11	2·65	2·80	—	—	—	—	—	—	Disqualified
1766	Miss C. Booth	Didgemere Salome	Saanen	Feb. 2, 1931	Mar. 4, 1934	486	5 1	4 7	9 8	3·40	3·35	9·50	0·41	3·60	19·51	—	19·51	Highly Commended
1768	Miss C. Booth	Springfield Lorelei	Saanen	Feb. 27, 1932	April 4, 1935	90	5 7	4 12	10 3	3·10	4·00	10·18	7·23	0·90	18·31	—	18·31	—
1769	Miss M. Owen	Dissington Snowball	Saanen	Feb. 3, 1933	Mar. 16, 1935	109	7 14	6 10	14 8	3·15	3·15	14·50	9·14	1·00	24·64	—	24·64	Third Prize
1771	Mrs. Knight	Springfield Colleen	Br. Saanen	Feb. 17, 1932	Feb. 20, 1935	133	5 4	4 10	9 14	2·60	2·60	—	—	—	—	—	—	Disqualified
1773	Miss M. Owen	Mostyn Marigold	Br. Saanen	Feb. 15, 1928	Mar. 15, 1934	475	10 15	8 13	19 12	3·50	3·65	19·75	14·12	3·60	37·47	—	37·47	First Prize
1775	Miss M. Owen	Mostyn Matchless	Br. Saanen	Mar. 20, 1932	April 6, 1934	453	5 2	5 2	10 4	3·75	3·50	10·25	7·43	3·60	21·28	—	21·28	Fifth Prize
1777	Mrs. Morcom	Cornish Pitch	Br. Alpine	Feb. 18, 1933	Mar. 27, 1935	98	4 14	3 15	8 13	3·70	3·60	8·81	6·43	0·90	16·14	—	16·14	—
1778	Mrs. W. A. Stirling	Bitterne Domino	Br. Alpine	Mar. 17, 1933	Mar. 15, 1935	110	6 14	6 6	13 4	2·90	3·00	—	—	—	—	—	—	Disqualified
1779	Mrs. W. A. Stirling	Didgemere Petunia	Br. Alpine	April 13, 1931	Mar. 11, 1935	114	7 5	6 4	13 9	2·55	3·00	—	—	—	—	—	—	Disqualified
1781	Mrs. W. A. Stirling	Twinstead Threepennybit	Br. Alpine	Mar. 18, 1933	Mar. 13, 1935	112	6 8	5 9	12 1	3·40	3·30	12·06	8·08	1·10	21·24	—	21·24	Reserve
1782	J. R. Egerton	Malpas Margarita	Anglo Nubian	Jan. 22, 1933	May 19, 1935	45	3 0	2 10	5 10	4·40	4·60	5·62	5·06	0·40	11·08	—	11·08	—
1783	J. R. Egerton	Malpas Merilees	Anglo Nubian	Feb. 16, 1932	May 27, 1935	37	7 15	7 15	15 14	3·10	3·90	15·87	11·11	0·30	27·28	—	27·28	Second Prize
1784	J. R. Egerton	Malpas Molly	Anglo Nubian	May 6, 1933	June 2, 1935	31	2 5	2 8	4 13	6·20	5·75	—	—	—	—	—	—	Disqualified (under $5\frac{1}{2}$ lbs.)
1785	Mrs. Hendy	Etherley Della	Anglo Nubian	Feb. 1, 1932	Jan. 17, 1935	167	2 11	2 9	5 4	4·50	5·10	—	—	—	—	—	—	Disqualified (under $5\frac{1}{2}$ lbs.)
1787	J. R. Egerton	Malpas Magna	British	April 17, 1931	Mar. 6, 1935	119	7 14	7 13	15 11	2·40	2·70	—	—	—	—	—	—	Disqualified
1789	Mrs. Morcom	Cornish Playful	British	Feb. 21, 1933	Mar. 28, 1935	97	5 14	5 9	11 7	3·20	3·00	11·43	7·09	0·90	19·42	—	19·42	Highly Commended
1790	Mrs. Morcom	Cornish Praline	Br. Toggenburg	Feb. 27, 1933	Mar. 31, 1935	94	7 4	6 1	13 5	2·55	2·70	—	—	—	—	—	—	Disqualified
1791	Mrs. Morcom	Cornish Saint	Br. Toggenburg	Mar. 18, 1932	June 6, 1934	392	6 1	5 14	11 15	3·40	3·60	11·93	8·35	3·60	23·88	—	23·88	Fourth Prize

CLASS 251.—QUANTITY.

No. in Catalogue.	Exhibitor.	Name of Goat.	Breed.	Date of Birth.	Date of last Kid.	No. of days in Milk.	Milk Yield. Morn.	Milk Yield. Even.	Milk Yield. Total.	Points. Milk.	Points. Fat.	Points. Lactation.	Points. Total.	Points. Deduction.	Points. Net Total.	Awards and Remarks.
							Lb. oz.	Lb. oz.	Lb. oz.							
1763	Miss M. Henderson	Riding Chloe	Toggenburg	Feb. 7, 1932	Feb. 8, 1935	145	4 0	3 11	7 11	7·68	—	1·40	9·08	—	9·08	—
1766	Miss C. Booth	Didgemere Salome	Saanen	Feb. 2, 1931	Mar. 4, 1934	486	5 1	4 7	9 8	9·50	—	3·60	13·10	—	13·10	Highly Commended
1769	Miss M. Owen	Dissington Snowball	Saanen	Feb. 3, 1933	Mar. 16, 1935	109	7 14	6 10	14 8	14·50	—	1·00	15·50	—	15·50	Fifth Prize
1773	Miss M. Owen	Mostyn Marigold	British Saanen	Feb. 15, 1928	Mar. 15, 1934	475	10 15	8 13	19 12	19·75	—	3·60	23·35	—	23·35	First Prize
1777	Mrs. Morcom	Cornish Pitch	British Alpine	Feb. 18, 1933	Mar. 27, 1935	98	4 14	3 15	8 13	8·81	—	0·90	9·71	—	9·71	—
1778	Mrs. W. A. Stirling	Bitterne Domino	British Alpine	Mar. 17, 1933	Mar. 15, 1935	110	6 14	6 6	13 4	13·25	—	1·10	14·35	—	—	Highly Commended
1779	Mrs. W. A. Stirling	Didgemere Petunia	British Alpine	April 13, 1931	Mar. 11, 1935	114	7 5	6 4	13 9	13·56	—	1·10	14·66	—	14·66	Reserve
1781	Mrs. W. A. Stirling	Twinstead Threepennybit	British Alpine	Mar. 18, 1933	Mar. 13, 1935	112	6 8	5 9	12 1	12·06	—	1·10	13·16	—	13·16	Highly Commended
1782	J. R. Egerton	Malpas Margarita	Anglo Nubian	Jan. 22, 1933	May 19, 1935	45	3 0	2 10	5 10	5·62	—	0·40	6·02	—	6·02	—
1783	J. R. Egerton	Malpas Merilees	Anglo Nubian	Feb. 16, 1932	May 27, 1935	37	7 15	7 15	15 14	15·87	—	0·30	16·17	—	16·17	Third Prize
1784	J. R. Egerton	Malpas Molly	Anglo Nubian	May 6, 1933	June 2, 1935	31	2 5	2 8	4 13	—	—	—	—	—	—	Disqualified
1787	J. R. Egerton	Malpas Magna	British	April 17, 1931	Mar. 6, 1935	119	7 14	7 13	15 11	15·68	—	1·10	16·78	—	16·78	Second Prize
1788	Mrs. Hendy	Broadwood Valentine	British Toggenburg	Feb. 14, 1930	Mar. 24, 1935	101	4 2	4 2	8 4	8·25	—	1·00	9·25	—	9·25	—
1789	Mrs. Morcom	Cornish Playful	British	Feb. 21, 1933	Mar. 28, 1935	97	5 14	5 9	11 7	11·43	—	0·90	12·33	—	12·33	—
1790	Mrs. Morcom	Cornish Praline	British Toggenburg	Feb. 27, 1933	Mar. 31, 1935	94	7 4	6 1	13 5	13·31	—	0·90	14·21	—	14·21	Highly Commended
1791	Mrs. Morcom	Cornish Saint	British Toggenburg	Mar. 18, 1932	June 6, 1934	392	6 1	5 14	11 15	11·93	—	3·60	15·53	—	15·53	Fourth Prize

CLASSES FOR BACON AND PORK PIGS AT THE NEWCASTLE SHOW.

THE Council has decided to discontinue the classes for Bacon and Pork Pigs at future shows, and hence it seems necessary to do little more than record the awards. These are set out in the tables on pp. 432–434.

As in the previous year, the great majority of the pigs entered in the bacon classes graded well as regards belly thickness, the forty individual carcases giving the following results :—

A	29
B	8
C	2
D	1

Again, as in the previous year, the grades attained for back fat were much less satisfactory, viz. :—

A	8
B	12
C	9
D	9
E	2

The payment grades represented a definite improvement on those of the previous year. They were :—

A	5
B	15
C	9
D	9
E	2

Even so, however, the whole of the entries averaged only twopence per score above the standard (Grade C) price, a fact which seems to illustrate the difficulty in producing an animal which is likely to qualify for a bonus payment under the scheme.

CLASS 430.—TWO BACON PIGS OF ANY PURE BREED.

Show Entry No.	Name and Address of Owner.	Breed.	Award Alive.	Grading. Back.	Grading. Belly.	Grading. Pay-ment.	Award Dead.	Remarks.
3058	Ernest A. Crookes, Rose Cottage Farm, Cutthorpe, Chesterfield.	Large White.	—	— D	— A	— D	—	Under weight.
3059	H. R. Davidson, Common Lane, Batford, Harpenden.	Large White.	—	D E	A A	D E	—	—
3061	Ernest Harding, Packwood Grange, Dorridge, Birmingham.	Large White.	—	A B	B B	B B	2nd	One pig very lean.
3063	Institute of Animal Genetics, Edinburgh University, Shothead, Balerno.	Large White.	4th	D E	A A	D E	—	—
3064	A. E. Law, Newborough, Peterborough.	Large White.	2nd	A A	A A	A A	Equal 1st.	—
3065	Ralph Millner, Angerton, Kirkbride, Carlisle.	Cumberland.	—	C D	A A	C D	—	—
3066	J. Pierpont Morgan, Wall Hall, Aldenham, Watford.	Large White.	1st	B C	A A	B C	3rd	—
3068	R. Silcock & Sons, Ltd., Bainesse, Catterick.	Large White.	—	C D	B A	C D	—	—
3070	R. Silcock & Sons, Ltd., Bainesse, Catterick.	Large White.	—	D D	A D	D D	—	—
3071	R. Silcock & Sons, Ltd., Thornton Hall Farm, Thornton-le-Fylde, Blackpool.	Large White.	3rd	A A	A A	A A	Equal 1st	—
3072	R. Silcock & Sons, Ltd., Thornton Hall Farm.	Large White.	5th	B C	A C	B C	4th	—
3073	Wyndham T. Vint, Thorn Cottage, Wroot, Doncaster.	Welsh.	—	B Under weight.	A	B	—	—

CLASS 431.—TWO BACON PIGS, FIRST OR SECOND CROSS BETWEEN ANY PURE BREEDS.

Show Entry No.	Name and Address of Owner.	Breed.	Award Alive.	Grading. Back.	Grading. Belly.	Grading. Pay ment.	Award Dead.	Remarks.
3074	H. R. Davidson, Common Lane, Batford, Harpenden.	*s* Tamworth.	2nd	B	A	B	4th	—
		d Large White.		C	A	C		
3075	H. R. Davidson, Batford . . .	*s* Tamworth.	—	C	A	C	—	—
		d Large White.		D	C	D		
3076	W. Dennis & Sons, Ltd., Kirton, Boston	*s* Large White.	—	A	B	B	Equal 3rd	—
		d Essex.		B	A	B		
3077	Ernest Harding, Packwood Grange, Dorridge, Birmingham.	*s* Large White.	—	B	A	B	Equal 3rd	—
		d Essex.		A	B	B		
3079	A. E. Law, Newborough, Peterborough.	*s* Large White.	Reserve.	A	A	A	1st	—
		d Middle White.		B	A	B		
3080	R. Silcock & Sons, Ltd., Bainesse, Catterick.	*s* Large White.	1st	B	A	B	2nd	—
		d Essex.		B	B	B		
3081	R. Silcock & Sons, Ltd., Bainesse, Catterick.	*s* Large White.	3rd	C	B	C	—	—
		d Essex.		C	A	C		
3082	Wyndham T. Vint, Thorn Cottage, Wroot, Doncaster.	*s* Welsh.	—	D	A	D	—	Soft.
		d Large Black.		B	A	B		
3083	Col. C. J. H. Wheatley, Berkswell Hall, Coventry.	*s* Tamworth.	—	C	A	C	—	—
		d Large White.		B	B	B		

CLASS 432.—TWO PORKERS OF ANY PURE BREED.

Pen No.	Name and Address of Owner.	Breed.	Award Alive.	Award Dead.
3097	John Whitfield, Earsdon Grange, Earsdon.	Large White.	1st	1st
3091	A. E. Law, Newborough, Peterborough.	Large White.	2nd	3rd
3095	R. Silcock & Sons, Ltd., Bainesse, Catterick.	Large White.	3rd	2nd
3087	T. H. Gladstone, Eastcote Grange, Hampton-in-Arden.	Middle White.	4th	—
3084	Ernest A. Crookes, Rose Cottage Farm, Cutthorpe, Chesterfield.	Large White.	5th	—

CLASS 433.—TWO PORKERS, FIRST CROSS BETWEEN ANY PURE BREEDS.

Pen No.	Name and Address of Owner.	Breed.	Award Alive.	Award Dead.
3102	Ernest Harding, Packwood Grange, Dorridge, Birmingham.	*s* Large White. *d* Essex.	1st	1st
3098	H. R. Davidson, Common Lane, Batford, Harpenden.	*s* Large White. *d* Berkshire.	2nd	2nd
3099	H. R. Davidson, Batford. - -	*s* Large White. *d* Berkshire.	3rd	—
3104	R. Silcock & Sons, Ltd., Bainesse, Catterick.	*s* Large White. *d* Essex.	4th	3rd

THE AGRICULTURAL EDUCATION AND RESEARCH EXHIBIT AT THE NEWCASTLE SHOW, 1935.

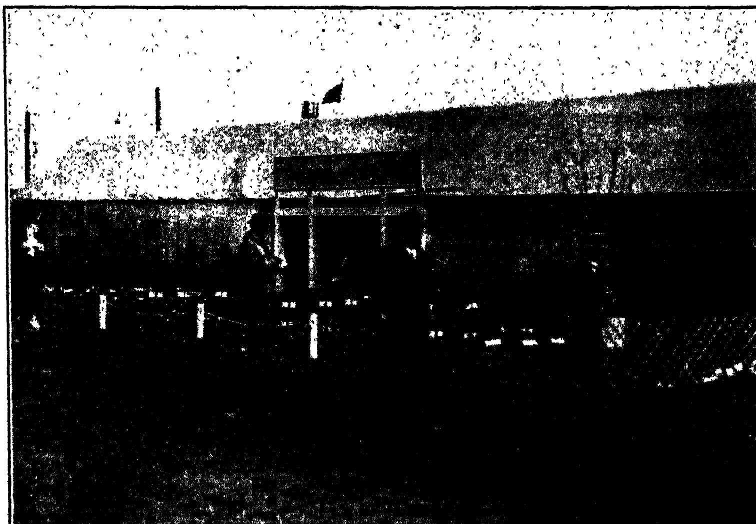
THE Education Exhibit at the Newcastle Show, covering an area of 120 × 130 feet, was designed to illustrate the application of modern methods to those particular branches of agriculture and horticulture on which educational and investigational work in the north is being concentrated.

The practical illustrations were made as self-explanatory as possible for every type of visitor. A serious effort was made to get rid of any tendency towards an exhibit of "museum" specimens and to make the exhibit alive and attractive, inviting, and productive of discussion at every point.

To do this every centre of agricultural education and research in the Province had to be represented, and the success was due

in a large measure to the whole-hearted and generous support, financial and otherwise, given by the four County Councils of Cumberland, Durham, Northumberland, and Westmorland.

Every phase of agricultural education was represented, and the centre-piece of the whole exhibit was a flood-lit panel illustrating by photographs and maps (1) the Northern Province and the various sources of advice to farmers and gardeners; (2) "Practice with Science," or the education of the young farmer; and (3) the recent modifications and developments in farm practice that have made educational work so essential.



Education Exhibit: Front of the Stand.

Horticulture.

The general plan permitted a portion of the horticulture section to adorn the main approach to the exhibit.

The Town Moor soil is not noted for its uniformity, and the laying out of the flower beds, etc., was a laborious and somewhat expensive task.

In addition to the purely ornamental part, the outside beds illustrated methods of fruit growing in the north. Part of the fruit demonstration was on wire fences, showing red currants, gooseberries, apples and pears trained as single cordons, double cordons, triple cordons and espaliers. Two large apple trees illustrated the method of "porcupine grafting" by means of which well-grown specimens of apple trees, which have proved unsatisfactory, have the main branches retained and a new and

more suitable variety grafted on so as to furnish the tree with side shoots and fruiting spurs within two years. Specimens of Paradise stocks Nos. 1, 2 and 9 were shown.

The black currants were of the four main varieties, viz., Baldwin, Boskoop, French Black and Goliath, all of which suit northern conditions. Other specimens, not necessarily of these varieties, showed the incidence of "reversion" and "big bud" and the effects of pruning, thinning, spurring, etc.

Varieties of raspberries which have proved satisfactory in the locality were shown, together with specimens of raspberries infected with mosaic and cane spot disease.

Two plots of potatoes illustrated the degeneration of potato stocks and the principal diseases that cause such degeneration. Healthy and degenerate stocks were seen side by side.

There was also an exhibit showing the production of synthetic dung for use by horticulturists and market gardeners who find it increasingly difficult to procure sufficient supplies of farmyard manure.

Inside was a bench exhibit consisting of a display of soft fruits and early vegetable crops suitable for northern conditions, along with examples of the ring-barking of trees, and samples of various forms of grafting. The effects of seed sowing under varying conditions of temperature and of spacing were on view. Recent work by Dr. F. T. Bennett on the diseases of fine turf (*e.g.*, of golf and bowling greens) was illustrated by samples and by cultures of the causal organisms. The control of these diseases, worked out less than two years ago, has received much international appreciation, and this section of the exhibit had not been included at previous Royal Shows.

The damage done by insect pests to fruit trees, bushes and vegetables was portrayed by numerous specimens, and details of the life-histories of the principal pests, together with preventive or remedial measures, were given. An endeavour was made to show all examples of diseases and pests in their natural environments.

A series of photographs depicting the success achieved in the planting up of waste slag heaps in County Durham, with different varieties of trees, created much interest.

Grass Land.

Completing the outside exhibit was a row of specimen turves from the more famous plots on Tree Field at Cockle Park. These turves, each measuring 10 feet by 5 feet, laid in the open, were in contrast to the usual method of illustrating pasture work by small turves in boxes. The larger turves were most effective in enabling the farmer to form a better idea of the grazing value of the pasture. Investigations are being carried out at Armstrong

College on different aspects of grassland husbandry, and the opportunity was taken to illustrate certain new features of this work.

The composition and feeding value of the herbage of upland sheep farms has not yet received the attention it deserves from research workers, and Mr. B. Thomas's interesting investigations on the composition and feeding value of four moorland plants, namely, common heather, draw-moss (cotton sedge), stool bent and bell heather, were well shown. The importance of these plants has been long upheld by hill farmers, and the results throw interesting light on these practical observations. These nutritional problems may have to be correlated later with the incidence of hill sheep diseases, which latter formed the subject of another section.

Investigations have been carried out for some time on certain of the well-known plots in Tree Field at Cockle Park, the value of which have, for years, been measured by the live-weight increases of sheep grazed on the plots. These live-weight increases are being compared with the results giving the annual output of dry matter and the proportions of its more important constituents.

Cockle Park was probably unique among agricultural experiment stations in this country in that for some years it was possible to find there three distinct methods of grassland management in use at the same time, viz., grazing by sheep alone, grazing by a mixed stock of sheep and cattle, and rotational grazing by a large head of stock for short intervals. The results of recent studies on the yield and composition of grass from all these experiments were illustrated. The production of grass for winter grazing has also been practised at Cockle Park, and the results of a preliminary study on the composition of such pasture at various stages during the winter period were given.

Other features of the exhibit dealt with the improvement of poor pasture in Westmorland by manuring and by re-sowing on a lea furrow, and examples of the damage done to pasture by smoke and gases from burning slag heaps in an industrial area. A very complete collection of grasses from Northumberland and Durham was staged, these being representative of the types found in (*a*) pasture ; (*b*) meadow ; (*c*) sea-shore and salt marsh ; (*d*) moor and marsh ; (*e*) woodland and hedgerow.

Crop Husbandry.

Two locally important points in connexion with arable crops were dealt with in this section, the first being the effects on various crops of lime deficiency in arable soils. All the important arable crops, viz., oats, wheat, barley, "seeds," pasture, potatoes,

mangolds, kale and clover, were shown growing in pots or boxes. In each case the effects of a definite lime deficiency could be seen and appreciated.

The second point dealt with the production of a cereal crop and because of its general importance in the north the oat crop was chosen. All stages, from sowing to the utilization of the crop, were illustrated and outstanding features were the effects of dates of sowing and grading of seed. The eradication of weeds was dealt with by the methods of spraying, and of particular interest to many farmers was the section devoted to plant diseases and the methods of control by treatment of the seed, before sowing, with mercurial compounds. The incidence of Fusarium diseases is perhaps not widely appreciated, and great interest was taken in specimens and cultures of these fungi, which are estimated to reduce British crops by 25 per cent. to 30 per cent. External infection by fungi can be largely controlled by treating seed before sowing, but internal infection cannot be controlled in this way, and dry heating of seed has not proved of practical utility. Investigations tend to show that methods of biological control offer the best means of checking Fusarium diseases, and this line of investigation is being followed up.

The most important insect pests of cereal and root crops were illustrated, and measures for eradication or control were given.

Poultry.

The section devoted to poultry husbandry received much attention from visitors, who were attracted not only by the material value of the exhibit, but by the very effective way in which it was displayed. The central feature gave a general statistical picture of the size and progress of the industry and of its economic experience in recent years. As the result of a three-years' survey over a number of farms, it was possible to prepare a diagram illustrating the financial results obtained on the individual farms. Great variations due to methods of management, marketing and other factors were found to exist, and the diagram brought out clearly the particular farm where results were consistent as against the farm where wide variation existed, and where it was obvious that attention should be directed to finding the reason for such wide divergence. Some of the causes of poor results were illustrated pictorially and the importance of healthy and vigorous stock, together with the importance of the personal factor and the principles which it has been found advisable to adopt, were emphasized. The more important diseases, such as Bacillary White Diarrhœa, Coccidiosis and Fowl Pox, were exhibited, and the steps to be taken to combat these were outlined.

Dairying.

A most successful feature of the exhibit was the small demonstration room with seats for about fifty visitors, and a platform for demonstrations in the making of ice-cream, soft cheeses and butter. Scores of tired visitors found a welcome rest here. Even when no actual demonstration was in progress they could study the products of the county dairy schools or discuss points of interest with members of the staff.

Special attention was paid in this section to faults too frequently associated with farm-house production of soft cheese and butter.

Milk Production Exhibit.

One section of the exhibit which aroused a great deal of interest and discussion was that devoted to methods suitable for production of milk of a standard necessary for the enrolment of the herd owner as an Accredited Milk Producer. This portion was arranged in collaboration with the Milk Marketing Board, by whom it was also financed. In view of the interest shown the staff was augmented by several members of staff of the Ministry of Agriculture.

The equipment and outfit was not too elaborate, but such as would be suitable for a dairy of up to about thirty cows. A room was equipped with models illustrating how alterations might be made to existing buildings for the purpose of improving ventilation, lighting and the most up-to-date standings.

Adjoining the model room was shown, in full size, the layout of a 30 lb. pressure steam boiler ; a washing-up room containing a steam chest, steaming block and a two-compartment wash trough ; a dairy with modern cooler and milk distribution equalizer with metal pipe rack for holding churns ; a small room containing the milk-receiving container and weighing apparatus ; a separate room containing a wash-hand basin and provision for hanging up milkers' overalls, etc.

The byre section, which was probably one of the most effective parts of the whole exhibit, contained full-size illustrations of three types of stall. An out-of-date stall—just removed from a byre to be renovated—with its wooden fittings, overhead wooden

Conversion of a Cowshed.

hay-rack, cobbled floor and very inefficient lighting, cleaning and milking equipment caused much comment. Next to it was a stall converted by the farmer with his own labour. This stall was an actual model of one regarded as very successful ; it was of dimensions suitable for Ayrshire cows, and full data as to the length of standing, width of gutter, types of trough, etc., were given. The stall was provided with a double water bowl, and was intended to be suitable for byres with no head feeding passage. The third was a modern tubular-fitted stall with individual water bowls, continuous trough and head feeding passage, and the type of electric light fittings found suitable for modern byres.

Live-stock.

The space along the back of the stand and at one end was open except for boarding sufficient to form pens for live-stock. Sheep and cattle could be seen without actually entering the pavilion, and these sections were well worth all the extra trouble which the care of live-stock entails. They attracted an endless stream of interested visitors at all times, and drew in many of those shy and reticent hill folk who all too rarely make contact with agricultural education.

Sheep.

Cheviot, Blackface and Swaledale ewes, the foundations of our lowland flocks, were shown with lambs by Border Leicester and, in the case of the Swaledale, Wensleydale rams. Ewes from these crosses, with lambs by suitable Down rams, carried the story a stage further and completed the picture of good commercial stocks in the district.

Running parallel with the sheep pens was a bench on which types of grazing from rough hill to fattening pastures kept pace with the improving sheep stock. Behind the turves were photographs and charts giving statistics.

The sheep story would not have been complete, however, without reference to diseases, the economic importance of which is being realized more fully every year. The exhibit was confined to the seven outstanding diseases of northern sheep—lamb dysentery, braxy, pining, "cripples," blood-rot, louping ill and tick-borne fever. Four pens of sheep suffering from scrapie, pining and blood-rot were exhibited. The nature of each of these diseases, and the appropriate preventive and control methods, were illustrated by models and paintings. In some cases charts, showing the results obtained by inoculation, were on view.

Cattle.

The cattle section consisted of six pens of animals along with a comprehensive and valuable exhibit of paintings, prints and photographs showing the development of the Aberdeen-Angus and the Shorthorn breeds.

The live animals exhibited were intended to show the chief breeds and crosses found in the area and used for beef production. They were :—

(1) A white Shorthorn cow with calf by Aberdeen-Angus bull.
(2) A pair of 15-months-old stirks by Aberdeen-Angus bull out of Aberdeen-Angus × Shorthorn cow.
(3) A pair of 15-months-old Aberdeen-Angus × Shorthorn stirks.
(4) A pair of 15-months-old stirks by Aberdeen-Angus bull out of blue-grey (Shorthorn × Galloway) cow.

(5) A pair of two-year-old blue-grey (Shorthorn × Galloway) steers.

(6) A pair of Shorthorn × West Highland steers, three years old.

PIGS.

Since the inception of the Pigs and Bacon Marketing Boards the great diversity of types of pigs in this country has been emphasized to a far greater extent than previously, and the object of this section was to illustrate how the home bacon trade can be supported if the pig breeder produces the type of pig which the bacon factory requires.

Four pens of live pigs were shown to illustrate certain features.

Pen 1. A pig of suitable type and correct weight for Class I.
Pen 2. A pig of correct weight but of unsuitable type.
Pen 3. A pig of suitable type but over weight.
Pen 4. A pig of suitable type but under weight.

Carcases corresponding to the live pigs were shown to illustrate the points regarded as important by the bacon factories, or the features that would result in a carcase being placed in a lower grade.

The bench display dealt with breeding, feeding and management problems, and an exhibit of hams illustrated the ill effects of unbalanced rations resulting in taints or faults of the bacon.

It is worthy of note that the appearance of the exhibit was greatly enhanced by the uniform labelling, lettering and decoration. This was entirely the work of members of the School of Fine Art, Armstrong College, to whom the Provincial staff wish to express their gratitude.

J. A. HANLEY.
D. T. ADAM.

Armstrong College,
Newcastle-upon-Tyne.

THE FORESTRY EXHIBITION AT THE NEWCASTLE SHOW, 1935.

TAKEN as a whole, the Forestry Exhibition at the Royal Show at Newcastle struck me as being of a very high order, both with regard to interest and to educative value.

Some of the uses to which coniferous thinnings were put seemed to me particularly ingenious.

The organization, and the way in which the various exhibits were arranged, were both admirable, and reflect the greatest credit on the Society.

In the Competitive Section, CLASS I was for *Specimens of*

Hardwood Timber, and was won by Lord Barnard's very fine exhibit. He showed boards of oak, ash, elm, a particularly fine beech and also a sycamore. The last unfortunately split, but not till after reaching the Show, and through no fault of the exhibitor.

The second prize went to Sir Charles Trevelyan, whose exhibit was also very good, but the specimens shown were not quite so large as the winner's.

CLASS II for *Specimens of Coniferous Timber* :

The first prize here went to Sir Charles Trevelyan's exhibit in which, again, the boards were of no great size, but a fine, even, clean-grown lot consisting of a Scots pine, a larch, a Douglas and a spruce plank; the last was the smallest.

The second prize went to the Duke of Northumberland, who showed a remarkably fine silver fir plank, the best by far in this section, but his Scots pine and Douglas planks were not quite up to the same standard.

CLASS III. *An Oak Field Gate for Farm Use* :

In judging the classes of Farm Gates, I awarded the prizes as far as possible to those gates which appeared to me to be the most cheaply made and, at the same time, efficient for the purpose for which they were intended.

The first prize went to Mr. Joseph Harris (No. 13), whose gate I thought a very useful and practical one.

The second went to No. 16, belonging to Lord Ridley. This was perhaps in some ways a better gate, but it appeared to have been rather more expensive to construct.

No. 12 was also a very good gate indeed, shown by the Dean and Chapter of Durham, but seemed to me rather unnecessarily elaborate for an ordinary field gate.

CLASS IV was for *Field Gates for Farm Use* made of any other *Homegrown Wood or Woods* :

No. 23, to which I awarded first prize, exhibited by the Duke of Northumberland, was a very practical, useful gate, not too highly finished.

No. 25, belonging to Sir Charles Trevelyan, and made of Douglas fir, was also a very good gate but a little more highly finished.

No. 29, which was really wrongly entered, but was intended for this class, was a very fine gate indeed—perhaps the best in the class—but I thought it rather too elaborate for ordinary farm use. The exhibitor was Colonel Warde-Aldam.

CLASS VI, for *Wicket or Hunting Gate*, was a very interesting class. Here I did not consider cheapness so much as self-shutting ability, strength and general usefulness.

Several of the gates shown were very well made and very neat, but No. 35, exhibited by Lord Ridley, made of oak throughout, was quite outstanding for both strength and self-shutting ability, so I awarded the first prize to it.

The second went to No. 32, belonging to Colonel Leather. This I thought a very nice little gate, but it seemed that the catch might be liable to damage by stock rubbing, etc., and it was hardly so good a self-shutter as the winner.

No. 37 was also a very interesting gate, belonging to Colonel Warde-Aldam, made of peeled round timber: this looked very neat indeed, but would take more making than some of the others.

Class VII was for *Tree Guards*. The Silver Medal went to No. 40, shown by the Lowther Estates, Ltd. It was most ingeniously made and was fitted with a little door that could be opened for pruning the tree, a most useful point in a tree guard.

Class VIII, for *Field Fencing*, was won by No. 43 from the Lowther Estates, a strong and useful fence, treated with creosote.

No. 45 was second, shown by Colonel Warde-Aldam, a useful fence showing great ingenuity in the using up of larch thinnings.

Class IX, for *Ornamental Fencing*, was won by No. 49, the Lowther Estates, Ltd. This was made of round varnished wood and was certainly much the most ornamental; the second, No. 48, shown by Colonel Leather, was a useful efficient fence made of Douglas fir.

Class X, for *Forest Transplants* and *Seedlings*, *Ornamental* and *Specimen Trees*, unfortunately produced only one entry, by Messrs. Thomas Matheson & Son, which was awarded a Silver Medal and well deserved it, as there was a very large selection of different species, and the whole exhibit had obviously entailed a lot of care and trouble.

Turning to the Non-competitive Section, there were some exceptionally interesting and instructive exhibits.

Major Mitchell's exhibit was particularly good and showed great originality. It consisted of sprays and cones of various conifers, samples of timber and cross-sections of the same conifers, and some very well shown samples of soil profiles. The last-mentioned were among the best exhibits of the kind that I have ever seen, and were most instructive.

Another very good exhibit in this section was that of Lord Allendale, showing in a most interesting manner the development from seed and the final uses of larch and sycamore. Some very well made small articles of the latter wood were shown.

The Northumberland County Council had also on view a very interesting exhibit of timber specimens and soil profiles.

Besides these, all of which were awarded Silver Medals, there were many other very good exhibits, too numerous to describe in detail.

The Chartered Surveyors had a splendid show, not for competition, composed of some magnificent boards of alder, larch, Spanish chestnut, oak, ash, etc. Also a very instructive exhibit showing the effects of "black heart" in ash timber, "white rot," etc.

The Special Silver Gilt Medal for the best general collection of exhibits both in the Competitive and Non-competitive Sections was awarded to Colonel Leather, who had a marvellous quantity of most interesting things on show, including some roofing shingles, a moveable planting shelter full of timber samples, the various parts of a farm cart, and many other items.

Taken all through, I think it will be generally admitted that the Forestry Exhibition was excellent.

J. Buchanan-Jardine.

Castle Milk,
Lockerbie.

JUDGE'S REPORT ON THE GATE MAKING COMPETITION, NEWCASTLE SHOW, 1935.

Before judging commenced in this competition, the stewards reported that three of the sets had been made strictly according to the conditions laid down by the Society, while three had been made by the use of the auger.

In consultation with the stewards, it was arranged that the gates should be judged on their merits, and that any exhibits which had been made by unauthorized methods should afterwards be eliminated.

The Larch supplied was evenly cut and of equal quality, so that all the competitors worked on level terms. An allowance of twelve minutes was given to competitors on sets Nos. 2 and 6 owing to their work being stopped pending the visit of the President. Some of the work was of a very fair standard so far as finish was concerned, the mortices being very well worked, but, with the exception of one gate, they were all out of square—in one case as much as 1 inch. The times varied greatly, the difference being 1 hour, 18 minutes.

The following are my notes on each set.

Gate Set No. 1.—*Time*: 3 *hours*, 10 *minutes*. The work was fair, the mortices being close fits and rigid. The gate was $\frac{1}{4}$ in. out of square, but the finish was clean. Awarded 3rd Prize. Prize disallowed as the conditions had not been complied with.

Gate Set No. 2.—*Time*: 3 *hours*, 12 *minutes*. The work was very fair, the mortices clean and good fits and the gate well built. This gate was ½ in. out of square. Awarded 2nd Prize. Prize disallowed as the conditions had not been complied with.

Gate Set No. 3.—*Time*: 2 *hours*, 27 *minutes*. This work was well finished with the exception of three mortices left large but made good in the finish. This gate was assembled by mallet and chisel only, and credit is due to these competitors for the best made gate, done in the shortest time, and only ½ in. out of square. Awarded 1st Prize.

Gate Set No. 4.—*Time*: 3 *hours*, 45 *minutes*. The work here was moderate; although the gate was nearly square, the morticing was left rather rough, and the gate was 3 in. short in height, but well braced and rigid. These competitors had worked with mallet and chisel only. Awarded 2nd Prize after elimination.

Gate Set No. 5.—*Time*: 3 *hours*, 36 *minutes*. This work was only moderately finished, the bars being incorrectly spaced, the mortices roughly done, and the gate ½ in. out of square. These competitors had worked with mallet and chisel only. Awarded 3rd Prize after elimination.

Gate Set No. 6.—*Time*: 3 *hours*, 23 *minutes*. This gate was 1 in. out of square, the top mortices were not good and the finish was faulty. These competitors had not complied with the conditions.

Edensor,
Bakewell.

J. R. Jackson.

REPORT OF THE JUDGES ON THE WOODLANDS, PLANTATIONS, AND ESTATE NURSERIES COMPETITION, 1935.

General Notes.

The competition this year was open to the counties of Cumberland, Westmorland, Durham, and Northumberland. There were forty-seven entries for eleven estates, of which one was in Cumberland, two were in Westmorland, one was in Durham, and seven were in Northumberland.

Viewing as they do a succession of representative estates over a defined area, the judges of this competition have an excellent opportunity of observing the features characteristic of that area—features in which the different estates resemble one another but which may differentiate them from estates in other parts of England. The coppice-with-standards system of Southern and South-Eastern England is one familiar example, and the mixture of several kinds of hardwood species with conifers in Central England is another. In the case of the area covered this year the common factor was one of management rather than of silvicultural treatment, for while the plantations on the various estates differed markedly in the species of which they were composed and the cultural treatment that was accorded to them, the high standard of conversion and utilization was most

striking in almost every instance. Successful utilization of thinnings, careful study of local markets, conversion on economic lines to meet local demands—all of these had been thoroughly examined and as thoroughly developed. And, probably as a result of this, there was not that preponderance of mature or over-mature timber which is so frequently to be found on private estates ; instead, the full-time working of the sawmills is leading automatically to the formation of series of age-classes which promise in course of time to become complete. This last is true of most of the estates visited (Healey in particular may be cited as an instance), but it was noted that, in the case of one or two of the estates, enthusiasm for efficient conversion had led to the installation of perhaps unnecessarily elaborate and expensive sawmill plants, etc., which seemed to the judges to be out of proportion to the size of the woodlands concerned and the actual output of converted material.

An interesting point noted was that while estates in Cumberland and Westmorland are able to dispose of sycamore thinnings and birch at profitable prices, these appear to be unsaleable in Northumberland. On the other hand, the propinquity of numerous coal mines provides the Northumbrian estates with a convenient market for the softwoods of which their plantations are so largely constituted.

The general standard of the woodlands and plantations entered was high, and necessitated very careful marking. In some of the classes only a very small margin of points separated the losers from the winners.

Cultural treatment in general was considerably above the average, and the general care of the plantations was excellent. Middle-aged plantations, especially those of European or Japanese larch, tended to be under-thinned—a fault, however, which is almost universal in present-day forestry, and one for which present-day taxation must bear the blame. On some estates softwood plantations have been pruned up to heights varying from 8 to 20 feet. The desirability of pruning and the height to which pruning should be effected is of course matter for debate, and the judges are aware that the tendency of modern opinion favours the removal of branches to a height greater than that which used to obtain. They felt, however, that the unarguable importance of thinning so far outweighs the debatable importance of pruning that the labour expended on the latter operation might instead have been expended with advantage on the former.

In the north of England, with its large areas at relatively high elevations, a preponderance of softwoods over hardwoods was only to be expected. It came as a pleasant surprise, therefore, to find that many owners have carried out with success the

establishment of hardwood plantations, in several of which oak is the chief constituent. It is a pity that a greater number of these were not entered in the classes for hardwood plantations.

The schedule of the competition comprises the following classes.

I. Where it is intended that hardwoods should form the final crop.
   (*a*) Planted from ten to twenty-five years.
   (*b*) Over twenty-five years of age.

II. Where it is intended that any of the following conifers should form the final crop, viz., Douglas fir, Sitka spruce, Norway spruce, Japanese larch, European larch, Corsican pine, Scots pine.
   (*a*) Planted from ten to twenty years.
   (*b*) Over twenty years of age.

III. Where the intention is to have a mixed final crop of conifers and hardwoods.
   (*a*) Planted from ten to twenty years.
   (*b*) Over twenty years of age.

IV. Plantations of any conifer not specified in Class II.

V. For the best managed estate nurseries.

VI. For the best managed woodlands on an estate of not less than 1,000 acres.

In Class I (*a*), *Young Hardwoods*, the silver medal was awarded to Lord Barnard for *Greatwood* (6 acres), Raby. This twenty-year-old plantation was originally constituted of oak 2, beech 1, larch 1, at four feet apart. The soil is a loamy clay, and the elevation 350 feet with a slight northerly aspect. Past treatment has consisted of the gradual clearance of the larch —the last of these having been cut out in 1934—so that the plantation now consists of oak with beech. The ground is fully stocked, and the general health and growth of the trees are excellent, the oak averaging 2½-3 inches quarter-girth and 20 feet in height. In a few places the beech are threatening to overtop the oak, and where this is the case it might be advisable either to top the beech or else clear them out altogether; but over the greater part of the plantation the oak are dominant, and altogether this may be considered a splendid example of a young stand of oak.

In Class I (*b*), *Older Hardwoods*, the silver medal was gained by the Lowther Estates Co., Penrith, for *High Donald Wood*, which also received the special gold medal offered by the Royal English Forestry Society for the best plantation entered in the competition.

High Donald, planted in 1880, is 8½ acres in extent, situated on red loam over limestone at an elevation of 850 feet. The original constitution of the crop, per acre, was sycamore 900, ash 300, larch 1,300, Scots pine 650, spruce 200. It is now a stand of pure sycamore, all the other species having been removed in the course of thinning. Returns from the last two thinnings alone (in 1924 and 1935) have yielded £260. Its present beautiful condition testifies to the skill and care with which it has been treated in the past. The trees (150 to the acre) are evenly spaced; the crowns are well developed and have ample room; the average length of clean bole is 35 feet; the mean quarter-girth is 8½ inches. The value of the crop to-day is probably about £90 per acre, and if it is as well cared for in the future as it has been in the past, it should produce a remarkably fine crop of first quality sycamore. In every respect it is deserving of the highest praise.

The bronze medal was awarded to Lady Henry Bentinck, Underley Hall, Kirkby Lonsdale, for *Winderwood,* a sixty-year-old plantation, 13 acres in extent, situated on loam over boulder clay, and constituted of oak, sycamore and ash, with a few elm and beech, and with an admixture of spruce, Corsican pine, and Scots pine. The last of the softwoods are now being removed, and sycamore is the dominant species remaining. The mean quarter-girth for both sycamore and oak is 8½ inches, the average length of clean bole being 30 feet. This is a nice stand which would have been in even better condition if the softwoods had been removed many years ago.

Another entry in this class, deserving of special mention, was *Ravensgill Wood,* belonging to Joseph Harris, Esq., of Brackenburgh Tower, Penrith. This is an eighty-year-old plantation of oak with a few sycamore. The mean quarter-girth of the oak is 9¾ inches, and the length of clean bole 40 feet. The quality of the oak is excellent, and this entry was a close runner-up in the class, losing points only on account of the somewhat scanty stocking on a small part of the area.

CLASS II (*a*); *Conifers ten to twenty years old.* The silver medal in this class went to the Doxford Estates Co. for *Shipley Hill Plantation,* an eleven-year-old, 9-acre plantation, of which the greater part consisted of Corsican pine (at 5 feet), a small area being planted with European larch (at 4 feet). The site is a bank facing south-west at an elevation of 470–520 feet. The soil is a loamy peat overlying sandstone, and is so shallow at the top of the plantation that it was found necessary to transport soil there in order that the young trees might be established. The result has been extremely successful. The area is 98 per cent. stocked; the Corsicans range in height from 11 feet to 16 feet (a very good height record for this species at this age); and the current annual height growth is 20 inches. Furthermore,

the larch, though they occupy only a small part of the area, are worthy of note, for in spite of their being only eleven years old they have already received a light thinning, and in fact constitute the best-thinned plot of this species viewed by the judges in any of the four counties.

The bronze medal was awarded to Lord Barnard for *Howgill Wood*, a 12-acre plantation of pure Scots pine, eighteen years old, on loamy clay at an elevation of 1,000 feet with a north-east aspect. The great snowstorm in the spring of 1933 caused some damage, but the plantation is 95 per cent. stocked, the health is good, and the height growth—ranging from 17 feet to 19 feet —is very good when one takes into consideration the exposed situation and the relatively high elevation.

Class II (*b*) ; *Conifers more than twenty years old.* Major Mitchell, Kyloe Wood Estate, won the silver medal in this class with a twenty-three-year-old plantation, 8 acres in extent, constituted of Douglas fir and Sitka spruce in pure groups. No fault can be found in this beautiful stand. In the case of both species the form of stem and crown is perfect. The height growth of the Douglas averages 45 feet, that of the Sitka 45 feet to 50 feet, both species having a mean quarter-girth of 5 inches. The plantation received a light thinning in 1927 and a heavy thinning in 1934. The present spacing is ideal.

The bronze medal went to Lord Barnard for *Middle Carrs*, a fifty-one-year-old stand of pure larch, 9 acres in extent. There are some 150 trees to the acre, the average height being 60 feet and the mean quarter-girth 10 inches. The general appearance of the crop is good ; the crowns are healthy, the bark clean, and the spacing even. The volume per acre, too, is high, and the value is considerable. The trees are a little inclined to lankiness, and an immediate thinning would be well worth while.

We cannot leave this class without making mention of *Robson's Plantation*, one of Colonel W. St. A. Warde-Aldam's entries from Healey. This is a fifty-seven-year-old stand of Scots pine, of excellent growth, quality and health, and missed receiving an award only by a very small margin.

Class III (*a*) ; *final crop to consist of Mixed Hardwoods and Conifers, ten to twenty years old.* No entry.

Class III (*b*) ; *final crop to consist of Mixed Hardwoods and Conifers, more than twenty years old.* The silver medal in this class went to Lord Barnard for *Basses Plantation*, twenty-two years old, 7 acres in extent, constituted of oak, beech, elm and larch. The soil is a heavy clay, the elevation about 300 feet, and the aspect south-westerly. It had originally been intended that the final crop should be hardwood, but in view of the good growth of many of the larch it has now been decided to leave

the best individuals of these with the ultimate object of securing a mixed final crop. The plantation is in process of being thinned, and has a full stock of well-grown stems of all species.

The bronze medal was awarded to Joseph Harris, Esq., Brackenburgh Tower, for *High Boundary Wood*, a thirty-four-year-old plantation, 5½ acres in extent, consisting of oak, sycamore, larch, Scots pine, and Norway spruce. It was originally intended that this should form a pure hardwood crop, but the spruce have thriven so well that a mixed crop is now the objective. Many of the oak are doing well, and it is a matter of interest that this species is, on the whole, doing better than the ordinarily faster-growing sycamore.

CLASS IV; *Plantations of rarer Conifers.* Major Mitchell, Kyloe Wood Estate, won the silver medal with a beautiful plantation of Thuya Lobbii, twenty-six years old, planted originally with larch in equal proportions. The soil is loam over clay, the aspect easterly, the elevation about 250 feet. Most of the larch have been removed, and the stand is now virtually pure T. Lobbii. A thinning was in process of being carried out during the judges' visit, and a comparison of the thinned and unthinned portions of the crop demonstrated the correctness both of the degree of thinning decided upon and also of the age at which the thinning is taking place. There are now some 700 trees to the acre, averaging 45 feet in height and 5 inches quarter-girth.

Colonel G. F. T. Leather, Middleton Hall, won the bronze medal with *Swinhoe Lake Block*, a nineteen-year-old plantation, 1 acre in extent, of *Thuya gigantea*, planted pure at 3½ feet. The soil is a dark loam, the aspect south-easterly, the elevation about 250 feet. This is a very promising stand which is about ready for a light thinning. The health and growth of the trees are excellent, the average height being 30 feet, with a quarter-girth of 4½ inches. There are about 900 stems to the acre. In view of the seven years difference in age, these measurements are comparable with those of the entry to which the silver medal was awarded.

CLASS V; *Estate Nurseries.* The silver medal in this class went to Colonel W. St. A. Warde-Aldam, Healey Hall, Riding Mill, Northumberland, for a nursery 1½ acres in extent. The general management and cleanliness of this nursery is excellent; seedlings and transplants are remarkably healthy; spacings between the lines and distances between the plants in the lines are just right to allow of proper root development. The soil and situation are ideal, and the system of cropping all that could be desired (about one-quarter of the area is under a cleaning crop, and of the remaining three-quarters one-half carries

transplants ready for planting out and the other half seedlings. Altogether, an admirable entry.

The bronze medal in this class was awarded to Joseph Harris, Esq., Brackenburgh Tower, for *Lazenby Fell Nursery*, 2 acres in extent. Situation, soil, and aspect are ideal, and the quality of the seedlings and transplants good, as also is the management. There is perhaps a rather large quantity of older transplants, but the judges understand that there is a ready local market for these (a further example of the differences in local practice necessitated by local requirements).

Class VI; *for the best-managed Woodlands on estates of not less than* 1,000 *acres*. This is inevitably the most interesting —and the most difficult—class to judge. Interesting because an individual plantation, however beautiful and however perfect, is after all an isolated unit, like a sentence divorced from its context; and, just as the merits of a sentence can only be appreciated when we know that which comes before and follows after, so the degree of success of a plantation can only be truly estimated when we consider it in relationship to the rest of the woodlands. A good plantation owes its excellence to the wise application of silvicultural knowledge, but the good management of a woodland area requires, as well as silvicultural knowledge, a knowledge of conversion, utilization, management, and mensuration, and a reasonable application of all of these. It is in the management of the woodlands rather than in the condition of individual plantations that the far-sightedness or otherwise of the owner and his forester become evident.

Judging is also complicated because almost every estate has its own particular problems which must be dealt with in an original way, and which are not easily comparable with the local problems of other estates, and because large estates which are well managed are apt to be more impressive than small estates, even though the management of the latter may be equally good; and again because the importance and potential value of amenity and sport vary so that, whereas on one estate the beauty of the countryside may be vastly influenced by forest operations, and any disregard of the fact must detract from the merit of the working policy, a neighbouring estate may be so situated that a regard for amenity is unnecessary or impossible. (The judges are instructed to take into account examples of systematic management for the production of timber, as well as ornamental planting, planting for sporting purposes, and improvement of residential amenities.)

The special silver gilt medal was awarded to Colonel W. St. A. Warde-Aldam for his woods at Healey. These woodlands, 1,618 acres in extent, are situated on a northerly slope at an elevation of 500–900 feet. The climate is bleak, and late spring frosts are

frequent. The mean annual rainfall is 30 inches. The soil is peat over sandstone or, in some parts, sandy clay with a clay subsoil. In the older woods Scots pine predominates, with Corsican pine, European larch and Norway spruce. The younger plantations are constituted of these species or of Douglas fir, Sitka spruce, Japanese larch, *Abies grandis*, *Tsuga heterophylla*, pure or in various mixtures. The greater part of the area is unsuited to the growth of hardwoods, but plantations of hardwoods (to the extent of 34 acres in the past fifteen years) have been successfully established wherever the soil and situation permit.

The growth and health of all the crops are excellent, this applying in particular to the Scots pine, which is obviously the tree of the country. The older stands are remarkably clean and even, and it seems likely that this species must always be of the first importance at Healey. The cultural treatment and care of all the plantations are good, thinning being on an equality with that of any of the other estates visited. Pruning is carried out but is in no way exaggerated. A notable feature is the exceptional tidiness of the woodlands, for there was hardly a fallen branch to be seen. On many estates such cleanliness might well be viewed with suspicion as incurring an unnecessary expenditure, but at Healey it is due to intensive utilization, and is in consequence wholly commendable.

The nursery has already been described under Class V.

Amenity is not of great importance, most of the woodlands forming no considerable feature of the landscape. Where, however, they do come into the view the question of ornament has not been neglected.

In the case of the larger blocks of woodland, shooting has been regarded as of lesser importance, but the smaller areas have a considerable sporting value, and maintenance of covert is carefully considered.

Conversion for local requirements has been thoroughly organized, and is carried out with efficiency and economy. A portable sawmill, run by a 10 h.p. steam engine, is employed, and is moved from wood to wood as fellings take place. The mill works full time, some 40,000 cubic feet of timber passing through it annually, the principal conversions being for baulks, fencing, colliery sleepers, etc. Thinnings of every size and kind are utilized profitably.

The woodlands have been under systematic management (with the exception of the years 1885–1920) for more than a century. As a result the series of age-classes is in a fair way to becoming entire, and would probably have been completely so but for the abnormal fellings necessitated by the Great War. The problem created by these fellings has been admirably

met. On so many estates, the owners of which are enthusiastic foresters, "backwardations" of this kind are wiped out by replanting on the grand scale with the result that, though the devastated areas are brought under production in the quickest possible time, a disproportionate area of even-aged forest is brought into being, and all hope of a sustained yield must be abandoned for at least a generation. At Healey, however, a wiser judgment is in evidence. Having a total woodland area of about 1,600 acres and (Scots pine being the dominant species) a minimum rotation of seventy years, the ideal annual coup under normal circumstances would not exceed 24 acres; but, to meet the devastated war areas, the annual planting during the last fifteen years has been increased to a mean of 54 acres, with the results that past excessive fellings have been wiped out, the woodlands will in future be worked on their ideal rotation, and the plantations that have been formed during this initial period are of a size and age series that can readily be absorbed into the correct rotation.

But it is in the matter of records that Healey is pre-eminent among the estates entered in the competition. The judges were given access to a remarkable record of forest operations, plantings, sales, costings, profits, etc., covering a period of more than 100 years, and so complete was this record that it would have been possible for them with its aid to view the estate and obtain all requisite information concerning the woodlands, even if no responsible person had been present to answer their questions. The record included an appendix containing a description of every compartment under the headings: Index number; name of plantation; situation; area; altitude; aspect; soil; previous crops; date of planting; species; treatment required; general notes. If there were added to it a chapter on future policy the report might well stand as a model working plan for private estate woodlands.

The silver medal was awarded to Colonel G. F. T. Leather, Middleton Hall, Belford, Northumberland. His woodlands, at present 650 acres in extent, are of great interest and educational value to foresters and owners of estates, because on this estate, more perhaps than any other, efficient conversion and utilization are regarded as the first and most important objective of the timber producer. At Middleton the sawmill is the centre of woodland management, and the plantations are the fodder which must keep it in food from year's end to year's end. This is evidenced by the equipment that has been set up for handling and converting the felled timber and which is probably as complete as any that can be found on a private estate—certainly more complete than any on estates of a similar size. A narrow-gauge railway, for example, connects all of the woodlands with the

sawmill, and by its means timber is conveyed direct from the felling area to the point of conversion. Arrived there, it is shot down a ramp on to a sliding table and carried into the mill. In the mill itself are a rack bench, a small circular saw for cutting firewood and small material, a band saw and a planing machine. In addition, there is a pressure creosoting plant 28 feet long by 6 feet diameter, with a capacity of 6,500 gallons. Equipment such as the above involves, of course, a very high capital cost, requiring a proportionately high annual turnover if a profit is to be shown, and at Middleton the sawmill is working at full time throughout the year—the acid test for any manufacturing concern.

The growth and health of the plantations are good. Softwoods cover by far the greater part of the area, the soil and situation being unsuited to broad-leaved species. Thinning is carried out systematically. Colonel Leather is a strong advocate of pruning and, in the case of Douglas fir, prunes his stems up to 20 feet.

Planting is proceeding at the rate of 25 acres a year, which (as new ground is being added to the forest area) indicates a rotation of approximately thirty-five years. Since local conditions enable small-sized material to be converted at a profit, this may well be the best rotation, financially, upon which to work the woods. The judges did not have access to figures showing costings or profit and loss in past years.

The bronze medal was awarded to H. D. Cuthbert, Esq., Beaufront Castle, Hexham. The woodlands on this estate differ markedly from those seen at Healey and Middleton in three respects, viz., size, history and conditions governing the working policy. As regards size, the Healey woods are more than 1,600 acres in extent, and those at Middleton are more than 650 acres, while the Beaufront Castle woods are about 250 acres. As regards history, the Healey woods have been under systematic management for more than 100 years, and those at Middleton for more than fifty years, but at Beaufront Castle systematic management has been inaugurated by the present owner. As regards conditions governing the working policy, both Healey and Middleton, because of their situation, have little need to pay any great attention to amenity, but at Beaufront one-fifth of the area adjoins the house, and amenity is in consequence of the first importance. It will easily be seen, therefore, that a comparison between Healey and Middleton, on the one hand, and Beaufront on the other is not easy to make, for Beaufront is, so far as the woodlands are concerned, of an entirely different character, and has entirely different problems and possibilities.

A woodland area of this size and description is in many ways more difficult to manage wisely than one of a greater area, and Mr. Cuthbert cannot be too highly commended for the good judgment with which he is tackling his many problems, and the

personal enthusiasm and attention with which he is forwarding the wellbeing of his woods.

No written working plan was shown to the judges, but the woods are being developed on a definite working policy. When Mr. Cuthbert took over the woodlands they consisted of the usual mixture—a few young plantations, with a preponderance of mature timber, about half of which was of good quality, while the remainder was more or less rubbish. He decided, rightly, that the removal of the rubbish and the substitution of productive young plantations was the first essential, and this has been effected during the past nine years with the results that: (*a*) there are now the beginnings of an age-class series; (*b*) productive young crops have been substituted for unproductive over-mature crops; and (*c*) future fellings should be entirely productive. (It is worthy of note that even during the initial years of the scheme the woodlands have been worked without loss and, in some years, at a profit.)

The young plantations are thriving and well tended, and the species planted have been well selected. A few marks had to be deducted for under-thinning in the middle-aged plantations, and for the preponderance of mature and over-mature timber, both of which faults, however, were due primarily to past rather than present policy.

The care of the amenity woods is exceptionally good. They consist for the most part of very beautiful oak and beech, of perfect form and considerable size. The boles have been cleaned and pruned, in deserving cases, up to more than 50 feet, all pruning and tree surgery operations having been carried out with skill and care. The judges have seldom seen an estate where the ornamental trees are so well looked after.

This estate forms a striking example of the financial possibilities of small woodland areas, and of what can be accomplished in the space of a few years by an enthusiastic and energetic owner.

NIGEL A. ORDE-POWLETT.
JOHN ADAMSON.

REPORT OF THE COUNCIL TO THE ANNUAL GENERAL MEETING OF GOVERNORS AND MEMBERS OF THE SOCIETY,

HELD AT THE

ROYAL AGRICULTURAL HALL, ISLINGTON, LONDON, N.,

On WEDNESDAY, December 11, 1935, *at* 2.30 *p.m.*

Membership.

1. The Council have to report that the list of Governors and Members has undergone the following changes since the Annual General Meeting on December 12, 1934: 20 new Governors (including 3 transferred from the list of Members under Bye-law 9), and 465 new Members have joined the Society, and 1 Member has been reinstated under Bye-law 14; whilst the deaths of 2 Life Governors, 11 Governors, 64 Life Members, and 159 Members have been reported. 8 Life Members and 16 Members have been struck off the books under Bye-law 12, owing to absence of addresses; 2 Governors and 98 Members under Bye-law 13, for arrears of subscription; 4 Governors and 295 Annual Members have resigned.

2. Losses by death during the year include three of the Society's governing body—Mr. Alfred Mansell, Major Clive Behrens and Lord Cornwallis.

3. Mr. Mansell joined the Society in 1879 and in 1909 he was elected to the Council as a representative of Shropshire. On the Finance, Journal and Education, Veterinary, Stock Prizes and Judges Selection Committees he rendered most valuable service over a long period. He took an active part during the War in the work of the War Emergency Committee set up by the Council. On the Society's behalf he appeared as a witness and gave evidence before the Royal Commission on Food in War-time.

4. As mentioned in last year's Report, the Council, to mark their appreciation, retained Mr. Mansell as a "nominated member" of their body when he ceased to be an elected representative.

5. Apart from his activities on behalf of the Royal Agricultural Society, Mr. Mansell for the greater part of his useful life

of eighty-one years had been a consistent worker in the cause of agriculture. He had a great reputation as a live stock auctioneer, was secretary of the Shropshire Sheep Breeders' Association from its foundation, and for long periods was secretary of the Shropshire Chamber of Agriculture and of the Shropshire and West Midland Agricultural Society. He had also been President of the Farmers' Club.

6. Major Behrens, who became a member in 1904, had represented the North Riding of Yorkshire on the Council since 1911. In 1912 he was elected a Governor. In the last quarter of a century he gave useful service on the Veterinary, Stock Prizes and Judges Selection Committees. He occupied a prominent place in the live stock breeding world, and for many years was a regular and successful exhibitor at the Society's shows in the classes for Hunters, Shorthorn Cattle, Sheep and Pigs.

7. Lord Cornwallis had been associated with the Society for more than fifty years, having been elected a Governor in July, 1884. In 1893 he joined the Council and from that time until his decease his was a period of continuous service in various capacities. Among the numerous duties he cheerfully undertook for the Society from time to time were those of Steward of Implements from 1896 to 1898 and from 1910 to 1916, Steward of Forage in 1899, Steward of Finance from 1900 to 1903, and Steward of Stock in 1904 and 1905.

8. During a very difficult and most critical time for the Society following the unfortunate shows at Park Royal, Lord Cornwallis accepted the office of President. The Derby Show of 1906 over which he presided proved to be a great success, and may be said to have been a turning point in the fortunes of the Society.

9. In the past forty-two years his lordship served on nearly all the Committees of the Council, and at the time of his death he was Chairman of the Journal and Education Committee, a position he had occupied since 1921.

10. Lord Cornwallis had a great record of public service, particularly in his own county, where he was affectionately known as "the squire of Kent." One of the "elder statesmen" on the Council, his passing is a grievous loss to the Society.

11. Though not on the Council at the time of his death last September, Mr. J. L. Luddington from 1909 to 1926 served as a representative of the Division of Cambridgeshire. In those years he took his share of work on the Committees, for fourteen of them he filled the office of Chairman of the Chemical and Woburn Committee, and he was one of the Society's representatives on the Lawes Agricultural Trust Committee.

12. Amongst other Governors and Members whose loss by death the Society has to deplore are His Grace The Duke of Buccleuch, K.T., His Grace The Duke of Richmond & Gordon, M.V.O., D.S.O., Viscount Bridgeman, Lord Dalziel, Lord Doverdale, Lord Gladstone, Lord Kirkley, Lord Somerleyton, G.C.V.O., Lord Vaux of Harrowden, Lord Woolavington, G.C.V.O., the Hon. A. H. Holland-Hibbert, Sir A. P. Ashburnham-Clement, Bart., Sir Herbert Gibson, Bart., K.B.E., Sir Alfred M. Palmer, Bart., Sir Henry C. M. Lambert, K.C.M.G., C.B., Sir Thomas Smethurst, K.B.E., Sir James Watt, Sir Sidney Wishart, Lieut.-Col. Sir F. Dudley Williams-Drummond, K.B.E., Mr. Thomas Ansell, Mr. J. Herbert Benyon, Mr. W. C. Brown, Capt. G. R. R. Colman, Mr. Charles E. Compson, Mrs. J. H. C. Evelyn, Mr. E. R. Fordham, Mr. F. W. B. Gubbins, Mr. R. Fletcher Hearnshaw, F.Z.S., Mr. C. T. Hoare, Mr. Samuel Kidner, Mr. James G. McDougall, Mr. Richard Medlicott, Dr. Thomas Milburn, Mr. H. C. Pelly, Lieut.-Col. W. Norman Pilkington, D.S.O., Mr. Arthur T. Pratt, Mr. J. W. Towler, Mr. E. G. Wheler-Galton and Mr. Lewis D. Wigan.

Numbers on Register.

13. These and other changes bring the total number of Governors and Members on the Register to 9,068, divided as follows:

143	Life Governors;
201	Annual Governors;
1,622	Life Members;
7,084	Annual Members;
18	Honorary Members.

9,068 Total numbers of Governors and Members, as against a total of 9,243 on the Register at the time of the last Annual Report.

Appeal for New Members.

14. In presenting the Accounts for 1934 Mr. Adeane, Chairman of the Finance Committee, called attention to the serious fall in the Society's membership since the year 1925, when the number on the Register was 13,620.

15. To increase the membership individual effort is greatly needed. Governors and Members are therefore particularly invited to endeavour to obtain new subscribers, and to suggest the names of any farmers or others interested in agriculture in their districts who would be likely to join the Society. The Secretary will, if desired, write direct to ladies or gentlemen named, or will forward a supply of application forms to any Governor or Member in order that he may himself send them to prospective members he may wish to nominate.

Presidency.

16. The Council have decided to recommend to the Annual General Meeting the election of Sir Merrik Burrell, Bart., as President of the Society to hold office until the Annual Meeting in 1936.

Changes in the Council.

17. On his return to England at the end of his term of office as Governor-General of New Zealand, Viscount Bledisloe has been elected a "nominated member" of Council. To fill a vacancy created by the death of Lord Cornwallis, H.R.H. The Duke of Kent, K.G., has been elected a Trustee.

Elections to the Council.

18. Members of Council retiring under the scheme of rotation at the forthcoming Annual Meeting are those representing the electoral districts of Group A comprising Bedfordshire, Cheshire, Cornwall, Derbyshire, Dorset, Hampshire and the Channel Islands, Hertfordshire, Lancashire and the Isle of Man, Middlesex, Monmouthshire, Norfolk, Northamptonshire, Northumberland, Staffordshire, Worcestershire, Yorkshire (North Riding), and Scotland. Governors and Members registered in those districts have been communicated with, and the usual procedure is being followed for the election or re-election of representatives for the Divisions concerned.

Dates of Council Meetings in 1936.

19. The Council have fixed the following dates for their meetings in 1936: February 5, March 4, April 1, May 6, June 3, July 1 (in Bristol showyard), July 29, November 4, December 9.

Accounts.

20. In compliance with the bye-laws, the Council beg formally to submit the balance-sheet with receipts and payments for the year 1934. These accounts were circulated to Governors and Members in June last, having been certified as correct by the Professional Accountants and Auditors.

Copies of these accounts, and also the Statement of Receipts and Expenditure of the Show held this year at Newcastle, will be available for reference at the meeting on December 11.

Newcastle Show.

21. The Town Moor, again placed at the disposal of the Society by the City Council and Stewards and Committee of the Freemen of Newcastle-upon-Tyne, was the site of the sixth Show held in that city, and exhibitors in all sections strongly supported the Society and made a most interesting and creditable display in all sections. The President, H.R.H. the Duke of Kent, honoured the Show with his presence on two days (Wednesday and Thursday), and in addition to conducting the business at the

Annual Meeting of Members, took a very keen and personal interest in all the departments which he visited and inspected. He was accorded a most enthusiastic welcome, particularly by the young people exhibiting in the Young Farmers' Club Live Stock classes.

22. Fine weather favoured the Show except during the early part of the opening day, and the attendance of 133,520, although not so large as on former occasions, was more than might have been expected in view of the very depressed conditions in the industrial areas on Tyneside. The financial result, viz., a surplus of £6,505 14*s*. 2*d*., exceeded anticipations, and the Committee who took charge of the advertising and publicity work under Captain R. Embleton as Chairman, with Mr. Oswald MacBryde and Mr. F. Marshall as Secretaries, must be accorded recognition and thanks for the work they did in helping to secure this result.

23. Special exhibits made by local bodies were the Agricultural Education and Research Section organized by Armstrong College, and Electricity as applied to Farming and Rural Industries, staged by the North Eastern Electric Supply Co.

24. In the Stock Section special classes were provided for North Country Breeds of Ponies, Cattle and Sheep, and the entries made fully justified their inclusion at this Show. In the ring the special attractions in the afternoon were the Musical Drive of "F" (Sphinx) Battery of the Royal Horse Artillery, a Parade of Pit Ponies working in the mines of Northumberland and Durham, and Working Sheep Dog Demonstrations.

25. The British Herdsmen's Club, in conjunction with the Y.M.C.A., continued their good work for the welfare and entertainment of the herdsmen and grooms at the Show.

26. Votes of thanks were accorded to the Lord Mayor and Corporation, the Local Committee and the Freemen at the Meeting of Governors and Members in the Showyard, but particular mention must be made of the fact that the Town Clerk of Newcastle had created something in the nature of a record, he having been Local Honorary Secretary on three occasions when the Show had visited Newcastle, viz., in 1908, 1923 and 1935.

27. Visitors from overseas were again welcomed to the Show on behalf of the Council by Colonel Stanyforth, the Steward appointed for the purpose, and he was assisted during part of the Show by Mr. C. W. H. Glossop, M.P. Many colonial and foreign visitors were thus assisted to see the Show in the limited time at their disposal, and were afforded every information about the section in which they were particularly interested. High Commissioners, Agricultural Attachés to Foreign Embassies and

Legations, as well as Ministers and Officials of our own Government, and a party of 100 Farmers from New Zealand, were also conducted round the Show, and expressed their appreciation of the services and hospitality rendered to them.

28. On the Sunday after the Show a "rally" of the British Legion branches in the North Eastern Area was held in the large ring, the Society having agreed to place the grand stand and ring at their disposal for this purpose.

Clerk of Works.

29. The resignation of Mr. Thomas Brown, Clerk of Works, caused unfortunately through failing health, will be regretted by the members of the Society, and particularly by those who were exhibitors at the annual shows. He had served the Society for over fifty-seven years, and his devotion to duty, his helpfulness and courtesy had made him many friends. The Council has granted to him and Mrs. Brown a retiring allowance, and a record of his long and valuable services will be engrossed, signed by the President, and forwarded to him.

New Implements.

30. One Silver Medal was awarded by the judges of "New Implements" at the Newcastle Show to Messrs. Blackstone & Co., Ltd., for a Tractor Transportable Rake.

31. On the recommendation of the Judges, the Council have agreed to the tests of the Rotary Cultivator entered by the B. H. Brown Engineering Co., Ltd., and the One Horse Motor Mower entered by A. C. Bamlett, Ltd., being deferred until next year.

Tractor Trials.

32. The Implement Committee of the Council are at present considering the desirability of again organizing Trials of Agricultural Tractors, and they hope to make a recommendation to the Council on the question and as to date and place of such trials, if decided upon, early next year.

Young Farmers' International Judging Contest.

33. With teams representing the U.S.A., Northern Ireland, Wales, Scotland and England the entry for the 14th International Dairy Cattle Judging Contest, held in the showyard at Newcastle, constituted a record. Competition on this occasion was exceptionally keen, and the English team only just won from Scotland, with Northern Ireland and the U.S.A. not far behind. The presentation of the Gold Cup and other awards was made by the President of the Society, H.R.H. the Duke of Kent.

34. England has now won seven times, the U.S.A. six times, and Northern Ireland once.

Young Farmers' Stock.

35. A new departure which aroused considerable interest at this year's Show was the exhibition of live stock belonging to members of Young Farmers' Clubs. Entries, of which there were about 150, were confined to members of the Clubs in the two counties of Northumberland and Durham. They provided a highly creditable exhibition, and were much admired when paraded in the large ring for inspection by the public. The President visited this section of the Show and personally congratulated the winners of the prizes on their good fortune.

Woodlands, Plantations and Nurseries.

36. Northumberland, Durham, Cumberland and Westmorland formed the area of this year's competition. There were 47 entries. Lowther Estates Limited gained the Royal English Forestry Society's Gold Medal for the best plantation. In the class for the best-managed woodlands on an estate of not less than 1,000 acres, the First Prize (Silver Gilt Medal) was won by Col. W. St. A. Warde-Aldam, D.S.O., Healey Hall, Riding Mill.

37. Gloucestershire, Wiltshire, Worcestershire and Herefordshire have been selected as the area for the Woodlands, Plantations and Estate Nurseries Competition in 1936.

Awards to Farm Workers.

38. Medals and certificates for long service have been awarded to farm workers this year as under :—

Years Service.	NORTHUMBERLAND.
58.	Robert Dunn, Beanley, Eglingham, Northumberland.
52.	James Turnbull, Shanklin House, Prospect Cottages, Bedlington.
51.	George Stanners, Shankhouse Colliery Farm, Cramlington.
48.	Ninian Anderson, West Wilkwood, Harbottle, Morpeth.
47.	Thomas Charlton, Newton, Harbottle, Morpeth.
45.	James Blain, West Learmouth, Cornhill-on-Tweed.
44.	Peter Pringle, North Moor Farm, Seaton Delaval.
41.	William Lindsay, Warton, Thropton, Morpeth.
41.	John Rogerson, Cartington, Thropton, Morpeth.
40.	Stephen Emerson, South Lodge, Blagdon, Seaton Burn.
40.	John Melrose, Beal Farm, Beal, Northumberland.
40.	John Purvis, Greensfield, Alnwick.
	DURHAM.
58.	John Johnson, 17, Grange Cottages, Coundon, Bishop Auckland.
53.	John Thomas Hardy, Green Head Farm, Howden-le-Wear.
50.	John Metcalfe, 8, West Avenue, Coundon, Bishop Auckland.
49.	Ralph Metcalfe, 6, Grange Hill, Bishop Auckland.
46.	George Hope, 5, Grange Hill, Bishop Auckland.
46.	John Joseph Jackson, West Newlands, Frosterley, Co. Durham.
44.	Thomas Rodgers, 17, South View, Merrington, Ferryhill.
43.	Thomas Espin, Cauney Hill Cottage, Bishop Auckland.
43.	John Turner, Over the Hill, Houghton-le-Spring.
40.	George William Wood, Upleatham, Marske-by-Sea.
40.	Mary Elizabeth Wray, High Quarry Burn Farm, Hunwick, Willington.

OTHER COUNTIES.

77. George Marshall, The Home Farm, Audley End, Saffron Walden.
67½ Ephraim Burton Judge, The Bungalow, Barnards, Vines Cross, Sussex.
61. Benjamin Hygate, 2, Warren Cottages, Handcross, Sussex.
60. George Joles, Thatched Cottage, Satchell Farm, Hamble, Southampton.
50. Robert Crowe, Appleton Farm, West Newton, King's Lynn.
48. Thomas Simpson, Charlwood, Ropley, Hampshire.
47. William Neller, Charlwood, Ropley, Hampshire.
45. William Broomfield, Grange Farm, Netley Abbey, Southampton.
43. John James Binks, Church View, Well, Bedale.
43. John Sayers, 3, Twineham Grange Cottages, Twineham, Haywards Heath.
42. James Squires, Colworth, Chichester.
41½. John Faulder, Brackenburgh Home Farm, Calthwaite, Penrith.
41. George Housby, Old Garswood, Wigan.
41. Walter Charles Neame, 6, Chapel Row, Herne, Kent.

39. Service qualifying for a Medal is forty years on the same or different holdings with one employer, or forty years on the same holding with different employers. Farm workers (male or female)—excluding gardeners, grooms and gamekeepers—in any part of England or Wales, are eligible for the awards. Claims on behalf of farm workers must be made through County Agricultural Societies on special forms which may be obtained from the Secretary of the Royal Agricultural Society of England, at 16, Bedford Square, London, W.C.1.

Bristol Show, 1936.

40. The 95th Annual Exhibition of the Society will be held in Ashton Park, Bristol, on a site kindly provided by the Hon. Mrs. Smyth.

Prize Sheet.

41. Offers of Champion and other prizes have been received from the following:—Shire Horse Society, Clydesdale Horse Society, Suffolk Horse Society, British Percheron Horse Society, Hunters' Improvement and National Light Horse Breeding Society, National Pony Society, Arab Horse Society, Shetland Pony Stud Book Society, Shorthorn Society, Hereford Herd Book Society, Devon Cattle Breeders' Society, Sussex Herd Book Society, Sussex Cattle Breeders' Society of South Africa, Welsh Black Cattle Society, Longhorn Cattle Society, Aberdeen-Angus Cattle Society, English Aberdeen-Angus Cattle Association, Dun and Belted Galloway Cattle Breeders' Association, Galloway Cattle Society, Dairy Shorthorn Association, Lincolnshire Red Shorthorn Association, South Devon Herd Book Society, Red Poll Cattle Society, Blue Albion Cattle Society, British Friesian Cattle Society, Ayrshire Cattle Herd Book Society, English Guernsey Cattle Society, English Jersey Cattle Society, British Kerry Cattle Society, Dexter Cattle Society, British Goat Society,

Oxford Down Sheep Breeders' Association, Shropshire Sheep Breeders' Association, Southdown Sheep Society, Hampshire Down Sheep Breeders' Association, Suffolk Sheep Society, Dorset Down Sheep Breeders' Association, Dorset Horn Sheep Breeders' Association, Wiltshire Horn Sheep Society, Ryeland Flock Book Society, Kerry Hill (Wales) Flock Book Society, Clun Forest Sheep Breeders' Association, Lincoln Longwool Sheep Breeders' Association, Leicester Sheep Breeders' Association, Society of Border Leicester Sheep Breeders, Wensleydale Longwool Sheep Breeders' Association, Kent or Romney Marsh Sheep Breeders' Association, Welsh Mountain Sheep Flock Book Society, Black Welsh Mountain Sheep Breeders' Association, National Pig Breeders' Association, Large Black Pig Society, Gloucestershire Old Spots Pig Society, Essex Pig Society, National Long White Lop-eared Pig Society, National Welsh Pig Society.

Special Prizes are being offered in the Poultry section by the Croad Langshan Club, Sussex Poultry Club, Columbian Wyandotte Club, Buff Orpington Club, British Jersey Giant Club, British Black Barnevelder Club, Welsummer Club, Rhode Island Red Club, Plymouth Rock Society, Buff Plymouth Rock Club.

Closing of Entries.

42. Intending exhibitors at Bristol are reminded that the final date for receiving entries of Live Stock is MAY 9th. Entries for Produce close on MAY 20th, and entries for Poultry, Eggs, and Butter-making Competitions on MAY 30th.

Applications for space in the Implement, etc., Department must be made not later than March 20th.

Agricultural Education and Research Exhibits.

43. For the purpose of organizing Agricultural Education and Research exhibits at future Shows of the Society, a Committee has been formed consisting of three representatives of the Council, three of the Ministry of Agriculture, and one of the Agricultural Research Council, with power to co-opt representatives of the appropriate local bodies in the area of the two forthcoming shows and of the past show.

44. Under the chairmanship of Sir William Dampier, the Committee are now engaged on the preparations for the exhibition to be held in the showyard at Bristol next year.

Show at Wolverhampton in 1937.

45. The Corporation of Wolverhampton extended a cordial invitation to the Society to hold the show there in 1937. Lord Wrottesley has kindly consented to provide a site for the showyard in Wrottesley Park.

46. The invitation was conveyed to the Council by the Mayor of Wolverhampton, the Town Clerk and other officials personally at the Newcastle Show, and their kindness in attending the Show was referred to by the President in his address to the members at the General Meeting on July 4, when the invitation was accepted with acclamation by the Council and members present.

Show of 1938.

47. Cardiff, as has been already reported, will be the venue of the Show in 1938.

48. The Royal Welsh Agricultural Society have decided not to hold their annual exhibition in 1938, and as the result of a conference between representatives of the two Societies, arrangements mutually satisfactory to both bodies have been agreed upon with regard to the privileges to be extended to the members of the Royal Welsh Society.

Judges at Argentine Show.

49. The customary request was made to the Council by the Argentine Rural Society to appoint a Judge of Shorthorn Cattle for the Show at Palermo in September. Mr. Charles Crombie, of Cluny Home Farm, Sauchen, Aberdeenshire, agreed to undertake this duty, at the invitation of the Council. Towards the end of July the Society were asked to send another gentleman to Argentina to judge Hereford Cattle. Fortunately, at short notice, Mr. W. G. C. Britten, the Secretary of the Breed Society, consented to undertake this task.

German Agricultural Show.

50. The Secretary and Consulting Engineer visited the show at Hamburg at the end of May last, and interesting notes and observations have been made for the use of the Committees concerned in the organization of the Royal Show.

Chemical Department.

51. Again some falling-off in the samples submitted by members has been experienced, the numbers being now 93 as against 124 in 1934. But the applications made, while including but little of a routine nature, have frequently embraced questions of importance, and largely concerned with cases where illness or death of stock has occurred through the presence of injurious ingredients in purchased feeding-stuffs.

52. As regards the supply and prices of Fertilisers and Feeding-stuffs there has been but little change. The important matter of the occurrence—in feeding-stuffs—of Castor has, however, engaged close attention, and quite a number of cases have been investigated in which the trouble has been clearly traced to Castor being present. In none of these cases, however, has it

been possible to make use of the provisions of the Fertilisers and Feeding Stuffs Act as it at present stands, and the inability of these provisions to cope with such cases and to enable the trouble to be traced back to its original source, has been abundantly exemplified. It would, therefore, seem very necessary to get the Act strengthened in certain respects, so that it may be made a really effective one.

53. The Chemical Committee have to regret the death, in September, of Mr. J. L. Luddington, who from 1914 to 1927 had been their Chairman.

Botanical Department.

54. The climatic conditions throughout the greater part of the growing season were again characterized, in most parts of the country, by a deficiency in the rainfall. As a general result the enquiries reaching the Botanical Department were of a very similar nature to those of the two previous seasons. Damage to pastures through the spread of drought-resistant weeds or the invasion of burnt-out patches by annuals, and the failure of "seeds" sown under cereal crops, were noteworthy features. As before, plant diseases, with the exception of the foot-rots of cereals, were less serious than usual. The two distinctive features of the season were the unusually forward conditions of all crops at the beginning of the year, and the check to growth brought about by the severity of the frosts in May. The former state of affairs was responsible for a number of enquiries on the advisability of omitting the usual top dressings of artificial manures in the spring, whilst the latter resulted in many enquiries with regard to frost damage in crops, forest trees and garden plants. Their number, however, did not compensate for a falling-off in other sections, and the annual aggregate will probably be lower than in 1934.

Zoological Department.

55. Most of the well-known insect pests of crops are annually reported from one district or another, but certain of them are usually conspicuous in a particular year for special and widespread damage. This distinction, for 1935, would seem to belong to three very familiar insects—"leatherjacket," "cut-worms" and "Codling moth." Advice with regard to these and several other pests has been given to members of the Society, but the Zoologist would welcome an increase in the number of applications for information about any insect suspected of injuring plants or animals, or interesting for any other reason. A certain number of specimens have been received for identification, for the most part parasites of animals or insects attacking stored products.

Veterinary Department.

56. Members of the Society have as usual taken advantage of their privileges by consulting the College (through their local veterinary surgeons in many cases) in certain ailments of farm stock, and the College staff have freely given assistance in elucidating obscure disease problems, suggesting means either preventive or curative by which the losses have been curtailed.

57. There has been an increased demand for advice and laboratory help in the control of mastitis, the most common form of which (a chronic one) can be controlled by the separation of infected and non-infected cows based on the laboratory tests of their milk. It is advised that infected cows shall be milked last and segregated as far as local service permits ; and investigations are still proceeding in regard to the practicability of the treatment of infected animals.

58. A service has now been instituted by which small samples of milk from each cow in the herd are subjected to laboratory examination with a view to picking out those in the herd not yet showing *active* signs of the trouble. By this means it is possible to remove such cows or to detect them so that they are milked last in order to prevent infection of the healthy ones.

59. With contagious abortion, the blood agglutination test is now being increasingly recognized as the only really satisfactory way of dealing with this trouble, and there is a growing and welcome tendency on the part of the owners to have all breeding animals in the herd tested with a view to eradication rather than merely to test a few individual animals which are for some reason suspect.

60. An essential point which has to be emphasized is the separation of reactors and non-reactors when at liberty in pastures or in yards, and the value of calving down all animals in boxes, as it is at this time that there is most risk of the spread of infection, both from aborting animals and those which are expected but do not abort. When tied up it is worth while here to note that it is possible to keep reactors and non-reactors in the same shed without fear of contagion. Great care should be taken with newly purchased animals, which should be isolated until tested. That this eradication work is gaining popularity is evidenced by the numerous requests which reach the Research Institute.

61. A number of enquiries have been made regarding disease in young calves and a large number of carcases have reached the College for post-mortem examination.

62. Investigations have been made into contagious pneumonia and White Scour of calves, and some original work has

been done on similar lines to the research of continental and American authorities.

63. In regard to the other farm animals, advice has been given in respect of the treatment of warbles in cattle, elimination of lice from horses, and the effects of intestinal worms in colts; whilst numerous post-mortem examinations have also been made of pigs in connection with outbreaks of infectious disease.

Animal Diseases.

64. Outbreaks of Anthrax, Parasitic Mange and Sheep Scab during the first nine months of the year all showed a reduction on those for the corresponding period of 1934; the position regarding Swine Fever and Foot and Mouth Disease was not so favourable. Of the last-mentioned, there were several outbreaks in the first half of the year. After the end of June followed a period of freedom from fresh outbreaks, but on September 25 the Ministry of Agriculture, in the Press, called the attention of stock owners to the fact that four outbreaks had been confirmed on widely separated premises, two in Glamorgan, one in Monmouthshire, and the other in Warwickshire. In only one of these was the existence of disease reported by the owner of the animals. The diseased animals in all these outbreaks contracted the infection at Newport (Mon.) market on September 16, but it was ascertained that animals from the infected premises had recently been exposed in markets at Usk and Stratford-on-Avon. Owners, particularly those in South Wales and the Midlands, were therefore specially warned to keep a careful watch on the condition of health of their stock.

With reference to sheep scab, the Council have learned with satisfaction that, as the result of the energetic measures adopted, the disease has been completely eradicated from the Peak district in fourteen months. The Council wish to call particular attention to this fact, as it bears out what they have always preached, viz., that it only needs the goodwill of the farmers to bring about the desired end.

Bequest for Foot and Mouth Disease Research.

65. A sum of £100 has been bequeathed to the Society by George William Gordon, deceased, for the promotion of research work in Foot and Mouth Disease. The Council have decided to hand over this bequest to the Agricultural Research Council.

London Quarantine Station.

66. Although it passed out of the control of the Society at the end of March last year, the Council note with satisfaction the use made of the London Quarantine Station under the Ministry of Agriculture. One point disclosed by the figures for 1934 was the great help the free freights to the Union of South Africa were

to the importers in that country. The Council therefore decided to communicate with the High Commissioners of all the Dominions and Colonies urging that the subsidized freights arrangements which obtained when the station was first opened, and which ceased at the time of the financial crisis, should again be instituted.

67. In August the Ministry circulated to Breed Societies a statement showing that there was a deficit on the working of the station for the financial year of 1934 of £982. Although this deficit is in excess of the sum of £700, the average contribution contemplated by the Treasury towards the maintenance of the station, breeders and exporters of stock will be glad to learn that it is not proposed, without further experience of the working of the station, to make any increase in the fees charged for the use of the station. The question will, however, be reviewed in a year's time.

Attested Herds.

68. In February the Council had before them a circular letter from the Ministry of Agriculture, together with a document describing the arrangements in England and Wales made by the Ministry under Section 9 of the Milk Act, 1934, and approved by the Treasury, for promoting the establishment of cattle herds officially certified to be free from tuberculosis. The scheme came into operation on February 1. A letter embodying the Council's views and criticisms of the scheme was sent to the Ministry, and later these views were emphasized by Sir Merrik Burrell, Capt. Johnstone and Mr. Robert Hobbs on behalf of the Society at an interview with Ministry officials.

69. On the 8th August a letter was received from the Ministry stating that, after six months' experience of the working of the scheme, the Ministry had come to the conclusion that it needed revision in order to make it more attractive to herd-owners. The draft of a revised scheme was enclosed and observations were invited at an early date. It was not then possible to submit this to a meeting of the Council, but the Secretary forwarded the draft scheme to the Chairman of the Veterinary Committee, who wrote a memorandum embodying his observations, and these were supported by Mr. Burkitt and Mr. Glossop at a conference with Ministry officials on September 19.

70. It is understood that it is the Government's intention in the revised scheme to afford substantial financial inducements to owners of herds who undertake the eradication of tuberculosis from their herds and qualify for certificates of attestation. The Ministry of Agriculture and the Department of Agriculture for Scotland have been engaged in consultation with various agricultural bodies concerned with regard to the terms of the revised

scheme, and they hope to be in a position shortly to publish its terms.

71. The first register of herds, attested up to August 31, covers fifty-eight herds, thirty-one in England and twenty-seven in Scotland.

Accredited Producers' Scheme.

72. A resolution in the following terms passed by the Council of the Shorthorn Society received the support of the Council :—

"The Council wishes to draw attention to Condition A (1) of Part III of the Third Schedule of the Milk (Special Designations) Order, 1923, which Order has been adopted as regulating the conditions of the Accredited Producers' Scheme, namely, 'No animal which to the knowledge of the owner of the herd has at any time been tested with tuberculin and has reacted to the test shall form part of or be added to the herd.'

"In the opinion of the Council this condition, by encouraging producers to refrain from testing their herds, will be a deterrent influence in freeing our herds from tuberculosis, and will make it impractical for any Accredited producer to work up a Grade A (T.T.) or Attested herd.

"The Council recommends that the condition shall be deleted from the Order."

The Minister of Health, the Council were subsequently informed, had this provision under consideration in connection with the preparation of a new Special Designations Order, which will be proceeded with as soon as practicable. He was not prepared in the meantime to make an amending order to deal with this one particular matter.

Spahlinger's Bovine Anti-Tuberculosis Vaccine.

73. Having considered the Report on the Spahlinger Experiments in Northern Ireland, 1931-1934, the Council consider that a sufficient case has been made out, and that no time should be wasted or money spared in carrying out what further experimentation the Government's advisers think necessary.

Research Committee.

74. In recent volumes of the Journal there have already appeared reports on experiments at the Norfolk Agricultural Station on the disposal of Sugar Beet by-products. The feeding of beet tops to fattening cattle and to fattening sheep has been discussed. Now the account of the whole series of these experiments will be concluded by the publication in the next Journal of a report dealing with the manurial value of beet tops when folded by sheep and when ploughed in.

75. Investigations which have been in progress for some time have been carried a stage further with the aid of grants from the Committee. These include work on Lucerne and Clover inoculation, and on the use of electric power for barn machinery at the Rothamsted Experimental Station; and Research on Bovine Mastitis at the Animal Pathology Research Institute of the Royal Veterinary College.

76. New work for which the Committee have allocated grants this year is as follows: Grass Seeds Mixture Trials conducted by the Welsh Plant Breeding Station; Pig Feeding Experiments at Cambridge University Farm; an investigation into the eradication of Ticks from Sheep Grazings undertaken by Armstrong College; Walnut Culture at East Malling Research Station; and a new investigation at the Norfolk Station into the Cumulative Effects on a light arable soil of various methods in the disposal of beet tops and straw.

77. The report of the Research Committee on the progress of their work during the year will appear in the next issue of the *Journal*. The volume will also include *The Farmer's Guide to Agricultural Research in* 1934. A small number of reprints of the *Guide* will again be available for sale at a nominal price of 1s. to the staffs and students of Agricultural Colleges and Farm Institutes.

Royal Agricultural Benevolent Institution.

78. In response to a special appeal made to the Society by Lord Eltisley on the occasion of the 75th anniversary of the Royal Agricultural Benevolent Institution, of which he is Chairman, the Council have made a donation of £250.

Queen Victoria Gifts.

79. For the ensuing year the Trustees of the Queen Victoria Gifts Fund made a grant of £140 to the Royal Agricultural Benevolent Institution to be allocated as five gifts of £10 each to Male Candidates, two gifts of £20 each to Married Couples, five gifts of £10 each to Female Candidates: the distribution in each class to be left until after the election to pensions by the Institution.

Since the fund was raised in 1897, £6,580 has been paid over to the Institution.

Medals for Cattle Pathology.

80. In the annual examination for the Society's prizes held at the Royal Veterinary College, the Silver Medal was won by Mr. J. A. J. Venn, of Marlborough House, Saltash, Cornwall, and the Bronze Medal by Mr. P. M. Sutton, of 6, Holland Park Avenue, London. The examination was conducted by the Professors of the College and comprised written and oral work in the diseases of cattle, sheep and swine.

National Diploma in Agriculture.

81. At the thirty-sixth annual examination held this year at the University of Leeds from April 9 to 16, the following forty-nine candidates were successful in gaining the National Diploma in Agriculture :—

HUGH ARBUTHNOTT, Glasgow University & West of Scotland Agricultural College.
LESLIE ALBERT ARSCOTT, Seale Hayne Agricultural College, Newton Abbot, Devon.
RONDESLEY WILKINS BAKER, University College of Wales, Aberystwyth.
CHARLES MILFRED BRAYSHAW, University of Leeds.
ANNA BURNS, Glasgow University & West of Scotland Agricultural College.
GORDON KADWELL CABBAN, South Eastern Agricultural College, Wye, Kent.
HARRY CAVENDISH CURSON, University of Leeds.
CONSTANTINE DAMOGLOU, Seale Hayne Agricultural College, Newton Abbot.
MICHAEL JOHN DOUGLASS, South Eastern Agricultural College, Wye, Kent.
HUGH FERGUSON, Glasgow University & West of Scotland Agricultural College.
FREDERICK HENRY FOSTER, South Eastern Agricultural College, Wye, Kent.
GEOFFREY FISHER FRANCIS, University of Leeds.
MALCOLM GILLIES, West of Scotland Agricultural College, Glasgow.
EDWARD KENNETH GRIFFITHS, University College of Wales, Aberystwyth.
ARTHUR GUY, South Eastern Agricultural College, Wye, Kent.
WILLIAM HAIL, West of Scotland Agricultural College, Glasgow.
ERNEST GEORGE HARMER, Seale Hayne Agricultural College, Newton Abbot.
GEOFFREY PERCY JAMES HODDELL, Midland Agricultural College, Sutton Bonington, Loughborough.
CHARLES PATON HOWARD, West of Scotland Agricultural College, Glasgow.
JOHN FRASER HUNTER, West of Scotland Agricultural College, Glasgow.
JOHN JONES, University of Leeds.
CHRISTOPHER KINGSLEY, East Anglian Institute of Agriculture, Chelmsford.
WILLIAM KITCHENER LETHEREN, Seale Hayne Agricultural College, Newton Abbot.
JOHN ELWYN LEWIS, University of Leeds.
DAVID ELJIOUS LIVINGSTONE, University of Reading.
WILLIE REES LLOYD-JONES, University College of Wales, Aberystwyth.
WILLIAM LONGRIGG, Armstrong College, Newcastle-on-Tyne.
ARCHER LYNAM, Midland Agricultural College, Sutton Bonington.
WILLIAM SMITH MACFARQUHAR, West of Scotland Agricultural College, Glasgow.
JOHN MAIDMENT, University of Leeds.
WILLIAM MANGAN, 11A, Cheapside, High Road, Wood Green, London, N.22.
GEORGE JOYCE MATTHEWS, Midland Agricultural College, Sutton Bonington.

THOMAS NEIL, Armstrong College, Newcastle-on-Tyne.
DEREK GEORGE PALMER, Seale Hayne Agricultural College, Newton Abbot.
GEORGE PATERSON, Glasgow University & West of Scotland Agricultural College.
GRACE PICKEN, Glasgow University & West of Scotland Agricultural College.
WALTER WEIR RITCHIE, Glasgow University & West of Scotland Agricultural College.
JOHNSTON FRASER ROBB, West of Scotland Agricultural College, Glasgow.
JOHN ROBERT EDWARD ROGERS, South Eastern Agricultural College, Wye, Kent.
WILLIAM ALBERT SCRIVEN, Seale Hayne Agricultural College, Newton Abbot.
ANDREW SHARP, East of Scotland College of Agriculture, Edinburgh.
ISAAC SIBSON, Armstrong College, Newcastle-on-Tyne.
ARCHIBALD BOYLE SMART, Glasgow University & West of Scotland Agricultural College.
FREDERICK JOHN SOWERBY, Midland Agricultural College, Sutton Bonington.
JOHN RUSSELL STUBBS, Harper Adams Agricultural College, Newport, Shropshire.
FRANK SWANNACK, South Eastern Agricultural College, Wye, Kent.
THOMAS HERBERT THOROGOOD, 16, Catherine Street, Cambridge.
JOHN MARTIN WILLCOCK, Seale Hayne Agricultural College, Newton Abbot.
JOHN M. WILSON, West of Scotland Agricultural College, Glasgow.

National Diploma in Dairying.

82. The fortieth annual examination for the National Diploma in Dairying took place in September at the University and British Dairy Institute, Reading, for England and Welsh students, and at the Dairy School for Scotland, Auchincruive, Ayr, for Scottish students. Fifty-four candidates were examined at the English centre, of whom twenty-six were awarded the Diploma; and forty-six presented themselves at the Scottish Centre, of whom twenty-three obtained the Diploma. No candidate at either centre this year reached the standard for Honours.

Following are the names of the successful candidates:—

ENGLISH CENTRE.

AGNES ENID ARCHER, Studley College, Warwickshire.
LESLIE ALBERT ARSCOTT, Seale Hayne Agricultural College, Newton Abbot, Devon.
GRENVILLE RAYMOND HUGH BISHOP, Midland Agricultural College, Sutton Bonington, Loughborough.
ETHEL ISABELLA RUTH CALDER, East Anglian Institute of Agriculture, Chelmsford.
ALBERT CROFT, Midland Agricultural College, Sutton Bonington, Loughborough.
BETTY CRUICKSHANK, East Anglian Institute of Agriculture, Chelmsford.
FRANCES ROSEANNA MURIEL DAVIES, University College of Wales, Aberystwyth.

Robert Maxwell Dickson, Midland Agricultural College, Sutton Bonington, Loughborough.
Marion Goodfellow, The University and British Dairy Institute, Reading.
John David Griffiths, University College of Wales, Aberystwyth.
Annie Harries, University College of Wales, Aberystwyth.
Edwin Roland Witham Henson, East Anglian Institute of Agriculture, Chelmsford.
Joyce Amelia Holden, Studley College, Warwickshire.
Joyce Holland, Midland Agricultural College, Sutton Bonington, Loughborough.
Gwen Morgan Hughes, University College of Wales, Aberystwyth.
Maggie Mary Jones, University College of Wales, Aberystwyth.
Doreen Kelly, The University and British Dairy Institute, Reading.
Marjorie Massey, Lancashire County Council Dairy School, Hutton, Preston.
Elizabeth Ann Meredith, East Anglian Institute of Agriculture, Chelmsford.
Dorothea Nance, Studley College, Warwickshire.
George Howard Proffit, Midland Agricultural College, Sutton Bonington, Loughborough.
Blodwen Roberts, University College of Wales, Aberystwyth.
Iorwerth Roberts, University College of Wales, Aberystwyth.
James Morris Trew, The University and British Dairy Institute, Reading.
Jane Angharad Tudor, University College of Wales, Aberystwyth.
Joyce Muriel Walker, Lancashire County Council Dairy School, Hutton, Preston.

Scottish Centre.

George Thomson Chalmers, Skilmafilly Cottage, Auchnagatt, Aberdeenshire.
John Astbury Collier, Hill Farm, Stafford.
Annie Cook, Claynod, Kilmorie, Arran.
Hugh Ferguson, 8, Barochan Place, Campbeltown, Argyllshire.
Geoffrey Fisher Francis, 48, Huddersfield Road, Barnsley, Yorks.
Christian Jane Wedderburn Gall, Home Farm, Kininmonth, Mintlaw, Aberdeenshire.
Malcolm Gillies, Mission House, Bernera, Stornoway.
William Hail, Station House, Stepps, Glasgow.
Nannie MacNee Johnston, 2, Duke Street, Hawick, Roxburghshire.
Catherine Wilson King, Bowfield Farm, Uplawmoor, Glasgow.
William Longrigg, Howes Farm, Calthwaite, Penrith.
Augusta Margaret Jane MacKinnon, Borve House, Borve, Stornoway, Isle of Lewis.
Catherine Mathieson, 6, Park Circus Place, Glasgow.
Maria Ann Murray, Faugh Beeches, Heads Nook, Carlisle.
George Paterson, Laigh Parks, Killearn, Stirlingshire.
Grace Picken, Priorletham, St. Andrews, Fife.
Johnston Fraser Robb, 46, Murdieston Street, Greenock, Renfrewshire.
Ralph Segal, 106, Tantallon Road, Shawlands, Glasgow.
Alec G. Seton, 1, North Hill Court, Headingley, Leeds.
Ford Gibson Sturrock, Crofthead House, Neilston, Renfrewshire.
Fanny E. A. Sutherland, Lystina House, Lerwick, Shetland.
Nicklas Euphemia Wilson, Bellevue, Eddleston, Peebles.
Alice Wilson Gauld Wylie, Stockbridge, Dunblane Perthshire.

All the candidates at the Scottish Centre had been students at the Auchincruive Dairy School.

Exhibition of Irish Cattle.

83. In March the Council agreed to support a resolution passed by the Royal Ulster Agricultural Society "most strongly urging the Chancellor of the Exchequer, the Home Secretary, and the Secretary for the Dominions to make such arrangements as may be necessary for live stock from the Irish Free State to be admitted duty free into Great Britain and Northern Ireland for exhibition at Agricultural Shows."

Gold Medal.

84. As stated in the last Annual Report, the Gold Medal for 1934 for distinguished service to agriculture was awarded to Sir Arnold Theiler. In view of the fact that Sir Arnold was not likely to be in this country again for some considerable time, arrangements were made through the good offices of the Union High Commissioner for presentation to be made in South Africa. The medal was actually presented to Sir Arnold Theiler by General Smuts on the 17th April on the occasion of the show of the Witwatersrand Agricultural Society.

85. The Gold Medal for 1935 has been awarded to Lord Ernle, and was presented to his lordship by H.R.H. the Duke of Kent, as President, at the Council meeting on October 30.

Marketing Boards.

86. At their meeting on May 1, the Council passed a resolution viewing with grave anxiety the existing method of election of Agricultural Marketing Boards, and urging the Minister of Agriculture to reconsider this matter with a view to some alteration.

87. In view of the Minister's answer that he had no power to make any alteration in the provisions of a Marketing Scheme, the Council on July 31 gave instructions to their General Purposes Committee to put in a memorandum to the Milk Reorganization Commission expressing their opinion that both the construction and policy of the Milk Marketing Board need drastic amendment.

Representation on other Bodies.

88. Col. C. J. H. Wheatley has been appointed in place of Sir Merrik Burrell, resigned, as the Society's representative on the Committee set up in 1925 to administer a competition in live stock judging between the students of various farm institutes. Sir Arthur Hazlerigg and Mr. William Burkitt were appointed to represent the Society at a conference held on April 12 with reference to the future of the Sugar Beet industry. The Earl of

Radnor and Col. Wheatley represented the Society at a Conference on Pig Breeding called by the Agricultural Research Council on May 31. Prof. J. A. Scott Watson has been appointed to represent the Society on the Organizing Committee of the Fourth International Grassland Congress to take place in this country in 1937.

By Order of the Council,

T. B. TURNER,

Secretary.

16, BEDFORD SQUARE,
LONDON, W.C.1.

30th October, 1935.

ANNUAL REPORT FOR 1935 OF THE PRINCIPAL OF THE ROYAL VETERINARY COLLEGE.

THE position regarding the number of outbreaks of the various scheduled contagious diseases of farm stock was in all cases more satisfactory in 1935 than in 1934.

In the case of *Foot-and-Mouth Disease* the decrease has been approximately 40 per cent. Although much of the credit for this decrease is due to the energy with which outbreaks are dealt with by the officials of the Ministry of Agriculture, yet it must also be placed on record that earlier reporting of suspected cases by stock owners has played some part in limiting the spread of the disease. In this connection it must be borne in mind that outbreaks of Foot-and-Mouth Disease are divided into two classes : (1) "Parent" or initial outbreaks, and (2) outbreaks due to the spread of contagion from such "Parent" or initial outbreaks. It will be obvious that prompt reporting in the case of a "Parent" outbreak is the best method of preventing the further spread of the disease, with all the consequent inconvenience and loss.

As stated in the last Annual Report, the most exhaustive enquiries are made by officials of the Ministry, in every outbreak, to trace the source of the disease. As a rule, these enquiries are successful in all but the most important, viz., the "Parent" or initial outbreaks. It may not be out of place in this report to state that representations have been made to the Ministry on many occasions in recent years urging that the infected area declared in connection with a fresh centre of this disease should be of smaller extent than 15 miles radius. The radius, however,

cannot be reduced; for even within the last two or three years cases of Foot-and-Mouth Disease have been confirmed by the Ministry *before* the "Parent" outbreak, to which these have owed their origin, has been discovered by the authorities, and in many cases the disease had already spread to farms more than 10 miles from the site of the first case confirmed in the area. A consideration of these facts will suffice to impress upon every stock owner the urgent and paramount importance of immediately notifying the police of any *suspected* case of the disease, especially cases of sudden lameness and slavering at the mouth in the case of cattle, or sudden lameness in the pig or sheep; these being the symptoms the stockman should be on the look out for.

Bearing in mind the difficulty of the problem, the fact that there has been such a large decrease in the incidence of this disease in 1935 is a matter for congratulation.

The following table represents the monthly statistics of the outbreaks for 1935.

Month.	Great Britain.	France.	Germany.	Holland.	Belgium.
January	17	41	37	48	3
February	4	44	22	46	4
March	1	137	33	24	3
April	8	69	108	24	1
May	2	164	343	19	2
June	2	233	417	8	—
July	—	352	344	5	—
August	—	271	515	4	—
September	6	234	472	11	—
October	8	244	374	3	—
November	2	164	260	3	—[2]
December	6	60[1]	—[2]	—[2]	—[2]
Total	56		2,925	245	13

[1] Up to Dec. 15. [2] Figures not yet available.

Again in 1935 there has been no case of either *Rabies* or *Glanders*. For our freedom from rabies we must thank the quarantine regulations governing the importation of dogs and cats into Great Britain; and it is worthy of note that at least one case of attempted smuggling of a dog was detected, at an Airport, owing to the vigilance of the Customs authorities.

With *Bovine Tuberculosis* the position is much the same as last year. More and more local authorities are making an effort to deal with this scourge. Each year more counties are undertaking the periodic inspection by Veterinary Surgeons of all milch cows in their areas, in most cases under the supervision of a County Veterinary Officer. In some counties these inspections

are made every six months, in others three times a year, and in a few cases every three months. While, as stated in last year's report, these clinical examinations alone cannot be expected completely to eradicate Bovine Tuberculosis from our herds, they do lower its incidence to a great extent. Many municipal bodies now employ veterinary officers to visit and apply the tuberculin test to all herds supplying milk to the area under their authority, and this is a step in the right direction.

The following table shows the number of animals slaughtered under the Tuberculosis Order of 1925.

Year.	Animals slaughtered.
1931	18,603
1932	19,027
1933	20,908
1934	22,009
1935	22,203

In the case of *Anthrax* the figures are a little more favourable than last year.

Year.	Outbreaks.	Number of animals attacked.
1931	465	516
1932	344	418
1933	297	345
1934	395	453
1935	386	443

Swine Fever is in approximately the same position as in 1934.

Year.	Number of outbreaks.
1931	2,026
1932	1,555
1933	1,414
1934	1,832
1935	2,049

It is a matter for congratulation that the position regarding *Sheep Scab* is so much more favourable than last year, the decrease being approximately 40 per cent.

The following table shows the number of officially confirmed outbreaks.

Year.	Number of outbreaks.
1931	347
1932	361
1933	518
1934	684
1935	475

Parasitic Mange continues to show a slight decrease in the number of outbreaks, although the actual number of animals attacked was higher in 1935 than in 1934.

Mention has been made in former Annual Reports of the great loss to stockowners through the prevalence of *Contagious Abortion* and *Jöhne's Disease*. Jöhne's Disease is increasing, unfortunately, in many areas. The work in search of a reliable diagnostic agent is proceeding and promises success.

In the case of Contagious Abortion, it would appear that this disease was as prevalent as in the preceding year. As is well known to many stockowners, there are two methods of dealing with it, viz.: (1) testing and isolation (or disposal) of reacting animals, and (2) vaccination. It is to be feared that many owners are inclined to have their animals vaccinated without giving full consideration to the fact that by vaccination with the live organisms they are actually infecting their stock. Unless a herd is extensively infected (as shown by a blood test of every breeding animal) an owner should give this matter very careful consideration. Where the result of a preliminary blood test reveals only one or two reacting animals it is better to sacrifice these than vaccinate (infect) the remaining animals in the herd. On the other hand, should the test reveal 20 to 25 per cent. of reactors, the best plan is to vaccinate the remainder three months before they are again to be served.

In my last report reference was made to the appearance among poultry in East Anglia of a disease known as *Fowl Cholera*. Although this disease has not yet been eradicated the position is well in hand. Unfortunately, since the beginning of the year, another infectious disease of poultry (*laryngo-tracheitis*) has been diagnosed in this country. This disease is characterised by an acute inflammation of the larynx and trachea, and the mortality is very high. There is no treatment available that is of the slightest use and the prompt destruction of affected birds and deep burial, or burning of their carcases, offers the only chance of its eradication from a flock.

Fowl Paralysis has again been the cause of much loss to poultry farmers. There are two or three schools of thought regarding the actual cause of this disease. It has been claimed that coccidiosis plays a part in its onset, but it must be admitted

that many birds affected with true fowl paralysis are not infested with coccidia ; nor have they been so infested as chicks. It is held by some workers that the cause of the paralysis is a virus which obtains entrance when a bird lacks bodily tone owing to some other affection, such as heavy worm infestations, etc. From the available evidence it would appear that the cockerel plays a part in the spread of the disease. However, the lack of stamina among our poultry flocks, to which reference was made in my last Annual Report, plays a not inconsiderable part in the high mortality experienced during recent years, even on the best managed poultry flocks.

In conclusion, it is a matter for regret that the failure to elucidate many problems with regard to animal disease is largely due to a serious shortage of men capable of doing, and prepared to do, the work. The shortage of funds in the past for research work has now been rectified to a large extent, and the Agricultural Research Council is both expanding and co-ordinating the work. But owing to greater financial attractions offered by Local Authorities and by private practice, the demand for men for research work exceeds the supply. It is difficult to see how this can be overcome until the remuneration offered in the field of research is comparable to that offered elsewhere.

FREDERICK T. G. HOBDAY.

Royal Veterinary College,
London, N.W.1.

ANNUAL REPORT FOR 1935 OF THE CONSULTING CHEMIST.

ONCE more it falls to my lot to present the Annual Report of my work for the Society, this being the fifty-first year since I came into office in succession to my distinguished father. It gives me much pleasure and satisfaction, moreover, to know that, though my tenure has not been marked by the brilliance shed on the office by him, and though it exceeds his only in the matter of years, it has yet been honoured by the Council by their conferring on me the Honorary Membership of the Society, a recognition which I highly prize.

My work for members during the year has been marked by much the same features that I mentioned in my last report. Few members have occasion now to submit samples of a routine nature, but the enquiries made have had reference to more special cases, such as the examination of feeding stuffs which have been suspected of causing loss or illness of stock, and which call for the exercise of special care, experience, and, I might add,

judgment. In so far as concerns this aspect of the exercise by members of the privileges which the Society confers, I am glad to know that the Society's laboratory has maintained its position as *the* "authority."

The number of samples sent during the year has shown a slight falling off on 1934—93 samples having been submitted as against 121 then. In addition, analyses were made of 18 samples of Cider in connection with the Society's Show at Newcastle.

Prominent among the enquiries have been those where the presence of Castor-bean in feeding stuffs had been the cause of illness or death of stock, and, as is known, I have taken an active part in the movement to ensure the freedom of foods from this poisonous constituent, and to ensure the purity and good quality generally of what the farmer purchases. This, I must confess, has been no light task, nor one free from considerable anxiety, for, though I have had the active support of the Council of the Society and, I am assured, the sympathy of the agricultural community at large, I cannot say that I have had, to like extent, the co-operation of the trade. This has come out most clearly in the discussions which have taken place at the meetings of the Advisory Committee of the Ministry on the Fertilisers and Feeding Stuffs Act, of which I am a member representing the Royal Agricultural Society in particular. I have nothing but admiration to express as regards the consideration and impartiality shown by the Chairman—Lord Clinton—and by those on the Committee who represent, more or less, the interests of the farmer or of the analytical profession; but I must, at the same time, say that the strong—to my mind the undue—representation of the Trade on the Committee has been an element that has been a very difficult one to contend with. It was only the strength of the evidence that—if I may be allowed to say so—I was able to bring forward, and which was so ably backed by the deputation which attended on behalf of the Royal Agricultural Society, that succeeded in the end in securing the issue of the Fourth Report of the Advisory Committee, and which, in its conclusions, gave expression to the general belief in the harmful nature of castor-bean in feeding stuffs, and the consequent necessity of its entire exclusion from them.

This conclusion, with others consequent upon it, has been a matter of much relief to myself after the work I have done in trying to bring it about, and I have but to regret that, even now, with this Fourth Report before them, the Ministry of Agriculture have hesitated to put it into effect.

This matter I have felt to be of such importance that I have dealt with it by way of a separate section in the present Report.

Another matter which has been dealt with at some length in recent reports, but which remains, from a legal point of view, still undecided, is the question as to what constitutes the "offals" of wheat. The question at issue concerns most nearly the Millers' trade and the production of flour for human consumption, but it has also a bearing upon the materials other than flour which result from milling operations, and which are used as food for horses and cattle, sheep, pigs and poultry.

The term "weatings" has been brought in to designate wheat offals generally, but it is contended that the definitions thus introduced are not in compliance with the requirements of the Fertilisers and Feeding Stuffs Act. The case has been notified for appeal to the House of Lords, but, so far, has not come up for hearing.

It is satisfactory to report, however, that the several classes of wheat offals have considerably improved as regards freedom from foreign matter.

The same remark applies also to Barley meal.

There is little or nothing new, either in the way of fertilisers or feeding stuffs, to record, nor has there been any material change in the prices of these since the fall, noted last year, in the price of potash salts. Practical stability has been reached as regards this last, and I have, accordingly, not had occasion to make any further alteration in the Tables of Compensation for Unexhausted Values, as revised in March, 1935.

The only article which has shown decided fluctuation of price is Sulphate of Ammonia, and with it certain fertilisers that have to follow its course; but, as has been pointed out before, these changes are determined by considerations other than those of the demand and supply.

As was remarked last year, the supply of both fertilisers and feeding stuffs has been markedly in the farmer's favour, whereas the manufacturers of and traders in these materials have suffered considerably through trade depression.

To take fertilisers first: those supplying phosphate to the soil, such as Superphosphate, Basic Slag, Ground Rock Phosphate, and also Bones, have remained at the same prices as previously.

Sulphate of Ammonia stood at its February price of £7 2*s.* per ton until August, when the price fell to £6 14*s.* 6*d.* per ton. Nitrolim (Cyanamide), as usual, followed the lead; the price of Nitrate of Soda, however, was steadily maintained throughout at £7 12*s.* 6*d.* per ton.

Kainit and other potash fertilisers have undergone some changes of price; prices were low early in the year but rose in July. Thus Muriate of Potash, costing in January £6 16*s.* per ton, rose in July to £7 11*s.*, falling again somewhat in August to £7 5*s.* per ton. Sulphate of Potash at the corresponding periods

cost £7 18*s*. 6*d*. (January), £8 18s. 6*d*. (July), and £8 11*s*. (August) per ton.

Feeding stuffs prices have followed the usual course, being dearer in the winter months, and then gradually falling until September or October, when the tendency was again to rise.

Linseed cake (home-made), starting in January at £8 12*s*. 6*d*. per ton, gradually fell to £7 17*s*. 6*d*. in March and to £7 12*s*. 6*d*. in June. Cotton cake (undecorticated) cost £4 17*s*. 6*d*. in January and fell to £4 10*s*. in March, at which price it has continued. Little is heard now of Decorticated Cotton cake or meal, their place having been taken largely by Ground-nut (Earth-nut) cake, the price of which has varied between £6 15*s*. (January) and £6 per ton, this rising to £6 7*s*. 6*d*. and £6 11*s*. 3*d*. in September. Coconut cake has stood at £6 10*s*. per ton throughout, but Palm-nut cake and meal are but seldom available. Both Soya Bean cake and the Extracted Soya meal continue in demand, chiefly for dairy stock. Prices have been, for the cake £7 5*s*. to £7 12*s*. 6*d*., and for the meal 7*s*. 6*d*. to 10*s*. per ton less.

Maize meal and Maize products have been in fair demand, and were, generally speaking, of good quality. For Maize meal, prices have ranged from £5 12*s*. 6*d*. to £4 12*s*. 6*d*., with Maize Germ meal rather cheaper and Maize Gluten Feed 10*s*. a ton more. Wheat Offals have shown a decided improvement in quality, but rose in price, costing £6 7*s*. 6*d*. a ton in January, £5 5*s*. in March, and then rising to £6. Sussex Ground Oats have remained fairly steady at from £8 10*s*. to £8 2*s*. 6*d*. per ton.

So far as my experience goes, the Fertilisers and Feeding Stuffs Act, while it has undoubtedly been found useful in farmers' ordinary transactions and has afforded them considerable security in what they purchase, has done but little in following up cases where, through want of care or by actual intent, misrepresentation has occurred. This is exemplified in the cases to which special attention is called in this Report and which concern chiefly the occurrence of Castor in feeding stuffs. The difficulties put in the way, first by the Act itself, and then by the hesitation of the Ministry of Agriculture to take proceedings in cases where an offence has been committed, have told greatly against the Act becoming effective. Moreover, though in certain counties it may apparently be worked more or less energetically, there is undoubtedly not that enthusiasm about it that was expected at its introduction. As a means of checking fraud, it has to a large extent been ineffective, and there is little doubt that the causes mentioned have had much to do with the want of interest and energy displayed by the majority of County Councils in putting it into action.

Careful consideration of the position seems to be called for in the light of the experience gained since the revised Act of 1926 was brought in.

The chief drawbacks to the proper working of the Act consist, I consider, firstly in the fact that a formal sample (*i.e.*, one on which proceedings may ensue) can be taken only at the vendor's store, but not at a farm, nor yet in the course of transit, at a wharf, a railway station or the like; secondly, there is the provision that it is not in the power of County Councils to institute proceedings on their own initiative, as is the case with the Adulteration of Foods and other Acts, but that the permission of the Ministry of Agriculture has to be obtained before proceedings under the Act can be taken.

I feel sure that the Act will become a really useful and workable one only when it is amended in these two respects.

The clauses which provide the above reservations were introduced in the Act of 1926 with the object of securing the merchant against being chargeable with an offence based upon a sample which he had not necessarily had the opportunity of verifying as that of the goods he had sold, and also of putting a check on the vagaries of local tribunals. The Act has accomplished these objects, but unfortunately has thrown the balance into the opposite scale and has placed an obstacle in the way of imposing penalties upon those selling impure feeding stuffs. The Trade, experience has shown, is more than able to look after its own interests, and it does not require the backing-up of the Ministry of Agriculture. Again, though I was, as a member of the Advisory Committee, willing at first to agree that the ultimate decision as to prosecutions should rest with the Ministry, I have now come to the conclusion that this is not desirable, and I cannot see why the administration of this Act —as is the case with the Adulteration of Foods and other Acts affecting the public—should not be in the hands of County Councils and local justices.

Castor Bean in Feeding Stuffs.

This matter has, perhaps more than any other in my analytical work, engaged my attention, and I can feel that another year has been spent—I trust not unprofitably—in endeavours to secure the purity of the feeding materials supplied to the farmer. In this connection I must acknowledge the hearty support that I have had from the Chemical Committee of this Society, its Chairman and the Council generally.

Attention was drawn in last year's Report to the important influence which the Deputation of the Society to the Ministry of Agriculture had exercised in the framing of the decisions reached by the Advisory Committee on the Fertilisers and Feeding Stuffs Act. It was also indicated how fully these decisions—as set out in the Committee's Fourth Report (October,

1934)—were in accord with the views urged by the Deputation from the R.A.S.E. Council.

I need not repeat these, but will content myself with mentioning matters that have subsequently occurred, and which set out the present position—a position that appears to me, at least, as very unsatisfactory and as calling for careful consideration and future action.

It was established—as the outcome of the Fourth Report—that Castor was to be considered a "deleterious ingredient" (in accordance with Section 7 of the Act) and, as such, was to be wholly excluded from feeding stuffs offered for sale to the farmer. As a result of this it followed that the trade practice, hitherto existing, of allowing consignments of feeding stuffs to pass as "pure" if they contained not more than a certain percentage of castor, was one that could not be recognized as in compliance with the Act.

Under these decisions I have, accordingly, since worked, and have framed my reports on samples submitted to me.

I had hoped that the Report of the Advisory Committee would speedily bring about a change in the then existing practice of the Trade, and cause the latter to be more careful to see that castor did not occur in cakes and other feeding stuffs, more especially those which were imported from abroad. At first, this seemed to be the case, but about May and June of 1935 quite a number of cases were brought to my notice in which illness had been caused to stock—death having in some instances occurred—through giving to them, it was believed, certain cakes or feeding stuffs. In each of these cases, on samples of the food in question being sent to me, I found Castor to be present.

Where possible, attempts were made, through County Councils, to obtain formal samples of the foods with a view to instituting proceedings under the Fertilisers and Feeding Stuffs Act. Great difficulties were, however, encountered in this endeavour, largely because the Act stipulates that a formal sample (on which alone a prosecution can follow) shall be taken at the actual vendor's store, and not at the farm where the trouble has occurred. When the County Inspectors visited the stores from which the purchases had been made, it was only to find that there was none of the consignment left from which to take a sample. Enquiries made at wharves met with a similar result.

Ultimately, however, it was, in two cases, found possible to secure formal supplies, one being of a consignment of a compound feeding cake, the other of Linseed cake ("Expeller" brand). These were submitted to me and I reported Castor to be present in each case.

It is only fair to the manufacturers in one of these cases to say that, on hearing of the trouble experienced in different

quarters with stock fed on their cake, the firm concerned at once looked into the matter, called in all the cake of the kind that had been sent out, and made, as far as possible, liberal compensation to the purchasers. At the same time, they openly told me that they had found that, unknown to them, a portion of a consignment of cotton seed, which they had obtained from Brazil, and which was used in the compounding of their feeding cake, contained Castor-bean seed. To this, doubtless, the troubles were traceable.

The two County Councils, which had meantime obtained the necessary formal samples, had submitted them to me, and, on receiving my adverse reports, applied to the Ministry of Agriculture for leave to proceed under the Act.

The Ministry, however, withheld their sanction, giving reasons for their action which, in my opinion, were contrary to the decisions come to by the Advisory Committee and set out in their Fourth Report. Moreover, the different points urged by the Ministry had been severally and fully discussed by the Advisory Committee before coming to their conclusions, and it seemed to me that all that was necessary was to put these into action, more especially as they were backed up by evidence as to the illness and death of stock, and by veterinary testimony.

In the course of correspondence, the Ministry pointed out that the Act was never intended to be the means of subjecting an honest trader to a prosecution under Section 7; but this same clause provides the means by which the trader can free himself from any such charge; it also sets out the proceedure for following up the case to the original offender or to the source from which the trouble has originated. If every case of illness or death of stock from Castor poisoning is settled merely by the farmer receiving compensation for his losses, and no more is heard of the matter, the Act will fail miserably in its real intention, viz., that of securing the purity and good quality of what the trade supplies to the farming community.[1] This can be secured, in the case of Castor bean, only by insisting on its total exclusion. Importers must distribute only what has been guaranteed to be free from Castor, and traders in feeding stuffs and manufacturers of mixed cakes and meals must take care to see that this poisonous ingredient does not find its way into their premises. It has been said that it is impossible to check the freedom from Castor of every consignment that comes from abroad, but it is not asking more than is reasonable; it is done with human food, why not with cattle food?

[1] It was, indeed, the difficulty experienced, so long as the old Act of 1906 existed, in bringing the offence home to the person who was really to blame, that brought about the insertion of the clause in Section 7 of the 1926 Act which sought to provide for the following up of every case to its original source.

If importers were to insist on the goods they receive being Castor-free, a change would soon be brought about in the present, admittedly lax, way in which food crops are cultivated, the produce handled at the local mills, storehouses, or wharves, and the cargoes shipped, these being the means through which the trouble occurs. If it were recognized that this country would take only Castor-free goods, the export of anything not complying with requirements would soon cease. But, so long as there are those who are willing to take goods of a doubtful character, because of the lower price at which they are offered, so long will there be traders in this country ready to "chance" whether trouble may arise, or the cause of it be ascertained. And if the Ministry abide by their present attitude, any hope of ensuring the purity and good quality of what the farmer buys may as well be abandoned, and the Fertilisers and Feeding Stuffs Act will become even more of a "dead letter" than it is at present, hedged around as it is with conditions that prevent action being aken under it.

It is clear that a radical amendment of the Act is called for, mainly in the provision of greater facilities for the taking of formal samples and the initiation of prosecutions by the County Councils themselves.

I conclude this section by saying that it has been represented to me that my crusade against Castor is really a disservice to the agricultural interest, inasmuch as the insistence on purity would have the effect of raising the price of the foods which the farmer gets, and of depriving him of some useful foods brought from abroad which are occasionally liable to contain Castor. This argument comes, of course, from the Trade, and it has reference, perhaps, more particularly to the case of Ground-nut (Earth-nut) cake. It is argued that it is only exceptionally that any trouble is likely to arise and that, meantime, the farmer gets a useful food at a cheap price, whereas if insistence were put on its being free from Castor, a higher price would have to be charged, and the export of a useful source of food might be checked or entirely stopped.

This argument, however, cuts at the very base of the efforts which have been continuously made by the Royal Agricultural Society and other organizations, as well as, of later years, by the Ministry of Agriculture, to secure the purity and good quality of what is supplied to the farmer. So soon as impurity is allowed to exist and to pass unnoticed, there can be no check on the extent to which it may occur. More especially are the consequences of such laxity likely to be serious where poisonous materials are concerned, and their total exclusion must, accordingly, be insisted upon. Either security in purchases must be given or else everyone must be allowed to sell or buy whatever he likes.

As to the objection of importers and manufacturers that it is impossible to secure the exclusion of Castor from what they purchase, they have the remedy in their own hands. If they insist on being supplied only with what is free from Castor and refuse to trade in any other material, they will soon be able to secure this desirable end.

I am reminded of the experience I had at the beginning of my connection with the R.A.S.E., when it was stated by makers of linseed cake that it was impossible to secure the purity of the linseed sent to them from abroad, and so to manufacture a really pure linseed cake. It was then that the R.A.S.E.—after enquiries and practical experiments that I made—put out their definition of what "pure linseed cake" should be, and after a very short time, every maker of repute was found willing to guarantee his cake as up to the R.A.S.E. standard. And so it would be with Castor if the Trade would but insist on goods free from Castor being supplied to them.

I now briefly review a few cases which have been brought to my notice by members of the Society and which present some point of interest.

1. *Linseed Cake in Unsound Condition.*

A member sent to me for examination a sample of Linseed cake which he believed to be the cause of illness of cows to which it had been fed. The cake was of foreign manufacture, of the brand known as "expeller" or "screw pressed." I found the cake to be musty and, generally, in unsound condition, having a disagreeable flavour. Further, it had 17·42 per cent. of water—which is a high amount—and also over 2 per cent. of salt. Five tons had been delivered, and, on receipt of my report, 4 tons, still unused, were sent back and half-price only paid for the 1 ton consumed. The cows recovered on being taken off the cake. It seemed very probable that the cake had been sea-damaged and had been subsequently dried.

2. *Ground-nut Cake ("Expeller") containing Castor.*

A member, after reading my Annual Report for 1934 in the Society's *Journal*, called to mind that in the previous year he had had trouble with sheep to which he had given this class of cake along with Cotton cake, Maize meal, Wheat and Oats. His cows, which had then also had the cake, were similarly ill until the mixture was altered. When about to use the same mixture this year he decided to send me a sample of the Ground-nut cake to see if it was all right. On examining this I found it not to be free of Castor, nor as clean as it should have been. The member decided thereupon to give the "expeller" brand a wide berth in the future.

3. *Bran—in Unfit Condition.*

A member farming in Derbyshire wrote that he had a cow which showed symptoms of poisoning which a veterinary surgeon put down to some Bran that the cow had been having. A sample of the bran proved to be very acid and unsound and full of mites. It was quite unfit for feeding. The cow, although she had been very ill indeed, eventually recovered after the food had been changed.

4. *Pollards Adulterated with Coffee-husk ("Parchment").*

A well-known member of the Society, on finding that his pigs showed disinclination to eat some Pollards which he had bought at the price of £4 5*s.* per ton, went to a different merchant and got Pollards from him, and then the pigs were found to feed greedily. He therefore sent me a sample of the first lot, and this, when analysed, was found to contain a considerable admixture of a waste material, the outer husk—or "parchment," as it is termed—of the coffee bean. This is a fibrous, indigestible substance, and, as the fibre in the sample amounted to 25·04 per cent. (whereas genuine Pollards would have only 6 to 8 per cent.), it was not to be wondered at that the pigs did not care for the food.

On making further enquiries it was found that the vendor was a man in quite a small way who had only recently started business. He admitted that he had received from a London merchant an offer of "coffee bran," and had mixed some of this with good Pollards. He undertook not to repeat the offence.

Coffee-husk is quoted at £1 a ton, and finds a use for stuffing pillows, mattresses, etc.

5. *Muriate of Potash—mixed with Sand.*

A member sent a sample of what had been supplied to him as Muriate of Potash. Analysis of this gave the following results:—

Moisture	·56
Muriate of Potash	61·78
Quartz and Sand	26·63
Other Impurities	11·03
	100·00

In answer to the purchaser's complaint, the vendor explained that what he had sold was what had been left over from the year before and, having been lying about among leaf-mould and potting materials, had probably got mixed with these.

A sample of a further purchase was found to contain 84·23 per cent. of pure Muriate of Potash as against the 61·78 per cent. in the first instance.

6. *"Watcr Softeners."*

Several enquiries were addressed to me regarding ways of softening water and materials used for the purpose. It is well to point out that the kind of "softener" necessary must depend mainly upon the nature of the water in question, and that the composition of the water requires to be known before one can say what type would be best employed.

In one instance that came to my notice the "softener" consisted of lime (calcium hydroxide) with sodium phosphate. This was a modification of Clark's well-known lime process, the addition of sodium phosphate being useful, more especially in the case of boilers, in preventing "caking" on the sides, the lime removed from the water falling down in a fine powder which can be readily blown out or removed.

In a second case—that of a water used for dairy purposes—the softened water was found to contain only 11½ grains per gallon of total solids, and would have been quite good for both dairy and drinking purposes had it not been that galvanized iron pipes were used for conveying it, and that the soft water (which also contained 4 grains per gallon of sodium chloride) had acted on these, and dissolved an appreciable amount of zinc. Galvanized pipes or tanks should not be used in such cases as these.

The following is the list of samples submitted by members during the twelve months from December 1st, 1934, to November 30th, 1935 :—

Linseed Cake	5
Cotton Cake	1
Palm Kernel Cake	1
Ground-nut Cake	5
Compound Feeding Cakes and Meals	11
Cereals, Offals, etc.	19
Fish Meal	4
Whale Meat Meal	2
Compound Manures	7
Sulphate of Ammonia	1
Shoddy	10
Potash Materials	1
Lime, Chalk, etc.	3
Milk, Butter, Cream	1
Soils	6
Waters	8
Miscellaneous	8
	93

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ANNUAL REPORT FOR 1935 OF THE BOTANIST.

Whatever it may have been to those engaged in the production of crops, 1935 was a year of absorbing interest to an agricultural botanist. Its weather conditions were characterized by several wide departures from the normal, and each of these brought in its train phenomena more or less outside the range of ordinary experience. Thus, at the beginning of January, when plant growth is, as a rule, practically dormant, the grasses were growing steadily and pastures had the appearance generally associated with late spring. The unusually high temperatures for the time of year which had prevailed throughout the previous month and an ample water supply in the soil were responsible, too, for crops of wheat and winter oats being in such a forward condition that the foliage of those which had been sown early met across the rows. Still more unusual was the fact, to which attention was frequently called in the newspapers of the time, that barley was in ear. Specimens were sent by several members with enquiries as to what the fate of these ears was likely to be. It seemed a foregone conclusion that they would be killed by frost, but very little information could be found about the effects of frost on the plants at this stage of growth. The only available publication bearing on it came from an experimental station at Pusa in India, but as the crop there was at a more advanced stage of growth the comparison was not a good one. A crop was therefore kept under observation at Cambridge. It was self-sown and growing in a field of red clover. When first seen the ears were clear of the sheaths and sufficiently numerous to produce, under ordinary conditions, a crop of some three quarters per acre. In a normal crop the stamens of the flowers at this stage of growth would have broken and the ovaries would have begun to swell up to form the grain. But it was only very exceptionally that this occurred. The crop remained in this condition until the end of the first week of March, when, as the result of a spell of day temperatures little above freezing point and a light frost, the ear-bearing tillers were killed to the ground, whilst those which had not flowered appeared to be uninjured.

More remarkable still was the fact that potatoes left in the soil at lifting time shortened their resting period and produced shoots above ground. By the beginning of the year the haulm was a foot in length, but the spindly internodes and the small yellowish green leaflets gave it an appearance very unlike that of normal plants. Runners some six inches in length had formed below ground and had swollen at the tips to form pea-sized tubers when on January 13th a slight frost put a stop to further development.

The precocious growth was responsible for some interesting enquiries. It was naturally assumed that if it continued the wheat crops would inevitably become lodged. Two questions then arose : the one whether the crops should be grazed to check this tendency ; the other whether it was advisable to forego the use of top-dressings of nitrogenous manures in the early spring. There is a curious lack of experimental work on the effects of such grazing, which made it difficult to answer the former question definitely. It is a common practice on light soils, such as those of the fens, when the winters are sufficiently open for the crop to continue growing steadily. It undoubtedly reduces the risk of lodging and it is said that little, if any, loss of yield results if the grazing is stopped as soon as the rapid spring growth begins. The resulting consolidation of the soil is reckoned as a further asset. But how far these results apply to the heavy land on which so much of the wheat crop is grown is problematical. The second problem was more simple to deal with, for, given a variety known to stand well, the risks of its lodging through the application of a hundredweight of nitrogenous manure are slight. Its early application, too, was suggested rather than delaying to see what the condition of the crop was later in the spring. The grounds for this are to be found in the fact that it is, in the main, the tillers which have developed before the end of March which form ears, whilst those forming at a later date tend to die down without doing so. The most that can be expected from a late application, then, is a possible increase in ear size and grain weight.

The autumn-sown crops continued to make such steady progress that at the beginning of May it seemed possible that the 1935 crops would rival those of 1934. Wheat especially was then in a distinctly more forward condition than in the previous year and the traces of disease which were present in January and February had disappeared. About the middle of the month, however, a spell of cold weather set in which culminated in a frost, which will long be remembered, on the night of May 16th–17th. The growth of all crops came to a standstill. Recovery, retarded to some extent by the dryness of the soil, was slow, and even at the end of the first week of June wheat foliage still had a yellowish tinge. With the coming of mild weather and rain the crops again began to grow rapidly, but all probabilities of bumper yields had vanished. The only measure of the severity of the check to vegetation has been provided by a groundsman, who reported that before the frost mowing at three-day intervals was necessary to keep lawns in good condition and that for the next month the intervals were from seven to ten days. It was only to be expected that a frost severe enough to kill the foliage of oaks and, where it was expanded, of ash and of such plants as

stinging nettles and ivy would bring many enquiries to the Department. In relation to the devastation caused, particularly in orchards, the number of enquiries of any agricultural interest was small. They were confined mainly to the effects of frost on soft fruits, namely, raspberries at the flowering stage, currants flowering and beginning to swell their berries, and gooseberries about half grown. Specimens of currants, presumably damaged by the frost, were received a month later. In these the strings bore only some three or four berries, the remainder having fallen, though why any should have escaped destruction is not clear. Damage to conifers was evidently general, and specimens of species of Picea, Abies and Thuja, with the young growth discoloured and apparently killed, were received. The bulk of the specimens, however, were from exotic shrubs and garden plants of no agricultural interest, and the only noteworthy point was that malformed flowers of roses and lilies were being sent in for examination during the middle of June. Curiously enough the extensive damage done to the bean crop seems to have passed almost unnoticed at the time.

WEEDS.

The weed problems of arable land were responsible for few enquiries during 1935, possibly because conditions during the past three seasons have been exceptionally favourable for cleaning operations. The only unusual one was provided by *Ranunculus parviflorus*, a plant which had not hitherto appeared in the lists of troublesome weeds about which information was required. This was stated to have completely overrun several fields and markedly reduced their cropping capacity. Its early seeding habit and the likelihood of the seeds lying dormant in the soil for some years suggest that it may prove a difficult plant to keep under control by ordinary methods of cultivation. A small-scale attempt to kill it at an early stage of growth with a copper sulphate spray was unsuccessful.

But the weeds of grassland brought in a more normal number of enquiries. One weed, of minor interest owing to its limited distribution, was said to be particularly troublesome. This was the spotted medick (*Medicago maculata*). The young growth of this plant is generally grazed down, but as soon as the fruiting stage is reached stock leave it alone. The fruits are extremely spiny, spherical burrs which can cling tenaciously to the fleeces of sheep. Like so many leguminous plants, it is intolerant of sulphate of ammonia, and consequently its control should not be difficult.

The chief troubles were due to the drought. The burning out of grassland was in some parts of the country even worse than in the two previous years. The growth of the grasses proper ceased, and what little foliage they had turned brown and dried up,

whilst drought-resistant weeds continued to thrive more or less. The cumulative effects of bad seasons for grass and better, if not good ones, for weeds have now become marked. The weeds about which information was required were yarrow, ribwort and hard-heads (*Centaurea nigra*). Rest-harrow, ragwort and scabious have also become over-abundant in localities in which they form part of the usual grass flora. There is no simple method of eradicating these weeds and it will probably take years to restore the old balance between the grasses and these relatively useless plants. More consideration than usual will have to be given to the problems of stocking, to the value of early mowing and to the use of phosphatic and nitrogenous manures if these are to play their part as restorative agencies. Rest-harrow will probably prove to be the worst of these weeds to get under control, and in one extreme case which is under observation ploughing out the field appears to be the best method for preventing it from becoming derelict.

A vigorous growth of annual weeds was again common on the burnt-out patches, but it is unlikely that they will persist into the next season.

The only troubles of those depending on temporary grass which were brought to the notice of the Department were concerned with the difficulty of establishing a plant. The germination of the seeds and the early growth of the plants seems to have been satisfactory, but the soil was often too dry during June and July to supply the water requirements of the young plant and its nurse crop.

Plant Diseases.

It can again be recorded that the losses due to the attacks of parasitic fungi were below the average. A drop in the number of enquiries from 40 in 1934 to 21 may be some indication of this fact, though some reduction was to be expected on account of the destruction of so much of the fruit crop.

Amongst the more important diseases was the form of clover sickness resulting from the attacks of *Sclerotinia Trifoliorum*. The fungus spread rapidly during the mild winter months and its waxy, cup-like fruits, which are often overlooked, were to be found in abundance until well on in the spring. The chocolate spot disease of beans, due, it is now believed, to a nearly related fungus, was also abundant, and probably played a part in reducing the yield of the crop. The cereals were, on the whole, fairly free from disease. One enquiry raised the question whether the use of mercurial dusts such as agrosan was as effective a method of checking smuts as the older method of steeping with copper sulphate or formalin. It was prompted by the fact that a crop of barley raised from treated seed contained a considerable

number of smutted plants. The smut present was the so-called "loose smut" (*Ustilago nuda*), the spores of which are blown away or washed off by rain almost as soon as the ears emerge from the sheaths. This species is distinct from the commoner "covered" smut, *Ustilago hordei*, the spores of which remain in the infected grain and are then harvested with the crop. Mercurial dusts will stamp out this latter species effectively, but they are useless for the control of the former. The mode of infection of the two species is totally different. Spores of the covered smut become attached to the grain coats during threshing, germinate soon after the grain is sown and then infect the young shoot as it is pushing its way through the soil. In such a position they are readily reached and destroyed by fungicides. But the spores of the naked smut, which are set free when the crop is flowering, find their way to the stigmas of the flower and bring about the infection of the developing embryo. In spite of this it develops into a grain indistinguishable by eye from a normal one, and it is only when the plant it gives rise to reaches the flowering stage that the fact that it was infected becomes obvious. No fungicide can reach this hidden infection. The parasite can be killed without causing injury to the grain by heat treatment. But the hot water steeping treatment which has to be employed is troublesome, and in inexpert hands may lead to considerable impairment of the germinating capacity of the grain. It is therefore advisable when this kind of smut has appeared in a barley crop to refrain from saving any of it for seed purposes. The same is true of the very similar "loose smut" of wheat which mercurial dressings fail to control, although they are particularly successful in eliminating the "stinking smut" or bunt of wheat.

The only other group of cereal diseases to which attention should be called is that of the "foot rots," to which the frequently mentioned "whiteheads" belongs. Information is steadily accumulating about these and it is now known that Ophiobolus is not the only causative agent. The diagnosis of the various species is not always possible, for the fruits of the fungi on which it is based may only develop on comparatively old stubble. Thus the symptoms as shown by specimens transmitted for examination may give no conclusive evidence as to which of the fungi is present. The diseases appear to be neither more nor less serious than in the immediate past, and though very generally present no really serious outbreaks have been reported. It is probable that the system of rotating the crops is mainly responsible for keeping these soil-inhabiting fungi from spreading excessively, for, on infected soil, a second straw crop is usually appreciably more damaged than the preceding one.

As in 1934, the attacks of various mildews were severe, notably of *Erysiphe polygoni* on swedes.

Potato blight was again late in appearing and it was not until the rains of the early autumn provided it with favourable conditions that it spread to any extent. But it has once more to be recorded that second early varieties lifted from apparently healthy crops showed a considerable percentage of diseased tubers. Whether the haulms and foliage were really as free from infection as they were said to be may be doubtful, but the frequency of such reports is enough to suggest that the complete life history of the fungus may not be known.

Various Crops.

There were further indications of the increasing attention which is being paid to the cultivation of marrow-stem kale. The succession of dry seasons has brought out the fact that the crop is distinctly drought-resisting and that though its growth is checked by a lack of rain it is capable of making a very rapid recovery as soon as conditions become favourable. It has several other good characteristics, such as its freedom from excessive attacks of mildew, in which it compares very favourably with the swede crop, which it is tending to replace. It is apparently far less susceptible to the attacks of finger and toe than most plants of the group Brassica, though further information on this point is required. It is sufficiently hardy, too, to withstand the frosts usually experienced in the southern parts of the country, but in this respect thousand-headed kale may be the better plant. The feeding value and the cropping capacity, especially when well cultivated, have proved to be better than generally expected, whilst as a smothering crop it is ideal for cleaning purposes.

Maize cultivation has again provided several enquiries. The advice given, based on some years of experience under favourable conditions, was to refrain from even trying the experiment. Not only is the ripening of the grain problematical, but the difficulties of harvesting, and still more of drying the cobs, make it exceedingly unlikely that the crop can be produced anywhere in this country as cheaply as it can be imported.

Much the same is true of the soya-bean crop. It can be grown, and samples of home-grown seed were sent to two members who were interested in the possibilities of its cultivation. The seed was that of the only variety, out of some 200 tried at Cambridge, which it has been possible to keep in cultivation for more than two years.

The most out-of-the-way crop about which information was required was the wild rice *Zizania aquatica*. This is a North American swamp grass growing from six to nine feet high which produces an abundance of seed of no particular value except as food for wild fowl. To grow it the seed is scattered in still water with a muddy bottom or on permanently wet marshes.

It has been tried in this country, though with what results could not be ascertained.

Synonymous Varieties of Cereals.

The Botanist again had an opportunity for inspecting one series of the trials made for the Cereals Synonym Committee by the National Institute of Agricultural Botany. These are mainly of a routine nature involving the comparisons of suspected synonyms with the types contained in a large collection of the cereals in cultivation in this country and on the Continent. But one trial was of particular interest, for it aimed at determining whether an oat admittedly similar in all appearances to the well-known variety Victory differed from it in winter-hardiness. A succession of mild winters has provided no stringent test of this characteristic, and the most that was known was that when Victory and the reputedly hardier form were grown in alternating rows the proportion of plants surviving the winter was practically the same in both cases.

Of late years a technique for testing winter hardiness has been developed on the Continent,[1] and a station in Sweden which uses it extensively in its experimental work was asked to include the pair in its usual trials. It consented to do so, and later in the season reported that it could find no difference between the two and that neither was winter-hardy. Neither could any difference be established in trials made by the North of Scotland College of Agriculture.

The Cereal Synonym Committee, after finding complete agreement between the results obtained in the trials at the Welsh Plant-Breeding Station, Aberystwyth, and the Scottish Seed-Testing and Plant Registration Station with those at the National Institute of Agricultural Botany, reported as follows :—

Wheat.

Harold Sadd's Seeds, Ltd.'s (Ipswich) Standfast Yielder is a slightly impure stock of Bacton Masterpiece.

Oats.

Edward Webb & Sons (Stourbridge), Ltd.'s Ascot (1935 stock) is a synonym of Record.

John Swain, Ltd.'s (Bristol) January White Oat is a synonym of Victory.

(This oat is claimed to be a hardy selection from Victory. The Committee have given particular attention to hardiness, but are unable to confirm the claim that January White is superior to Victory in this respect.)

Barley.

Herbert Parker, Ltd.'s (Norwich), Norfolk Malting is a synonym of Spratt-Archer.

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[1] See *Farmer's Guide to Agricultural Research*, 1934, *this Vol.*, p. 182.

Although the enquiries had an even wider range than usual, the number fell off appreciably, being 160 as compared with 192 in the previous year. The deficiencies were most marked in the sections dealing with seed-testing and with the diseases of plants. The slight falling off, which has been evident for several years, is no doubt due to greater use being made of the advisory services provided by the Ministry of Agriculture, but the reason for this substantial reduction in number is not clear.

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ANNUAL REPORT FOR 1935 OF THE ZOOLOGIST.

INTRODUCTION.

IN the following Report it is attempted to give a brief indication of the pests which have proved destructive to the various crops during 1935. As is always the case, their incidence has been largely dependent on weather conditions, which have favoured some injurious insects but have discouraged others.

Each year is generally marked by the special prevalence of certain pests, and it is not difficult to name three which have done far more than the normal amount of injury during 1935. They are "leatherjacket," "cut-worms" and "Codling moth," and though there are few pests more familiar it has seemed desirable to deal with them at some length.

Early in the year the unwelcome discovery was made that root-eelworm disease, so prevalent among our potato crops, had made its appearance in crops of sugar beet. In view of this disquieting fact I have thought it advisable to include a short account of this serious pest in the subjoined Report.

CEREALS.

Fly attacks on corn crops were more in evidence than in 1934, but were seldom really serious. A few cases of frit-fly in winter wheat were reported, and wheat bulb-fly appeared in several crops in June. No case of the June attack of frit-fly on oats came to my notice but the second brood of the fly, which attacks the ear, caused some loss of yield in many districts.

The mud-beetle, *Helophorus nubilus*, was again found doing some injury to wheat, and all the cereals, in common with farm crops generally, suffered from the depredations of cut-worms and leatherjacket.

Root and Vegetable Crops.

As in 1934 certain common farm and garden pests were comparatively rare. Mangold-fly, carrot-fly and onion-fly were generally reported to be less than normally injurious, and in some districts celery-fly hardly occurred at all. The flea-beetles most complained of were of the species which attack plants of the cabbage tribe.

Cutworms.—Sugar beet suffered from a variety of pests. Mr. Petherbridge, at Cambridge, found examples of the roots being perforated at the end of June by small caterpillars which proved, on rearing, to be first stage larvae of Noctua moths, in other words, " cutworms " just hatched from the eggs. It was not until they had undergone one or two moults that their identity was recognized.

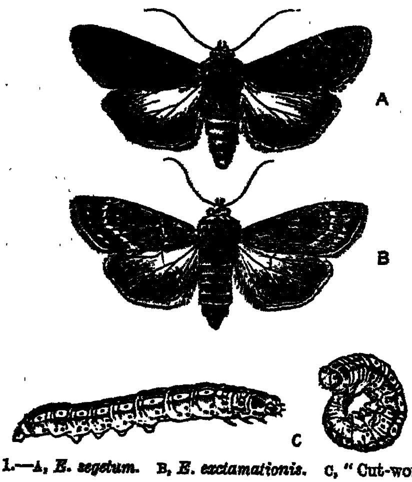

Fig. 1.—A, *E. segetum.* B, *E. exclamationis.* C, " Cut-worms."

The American term " cut-worm " has been universally adopted by English entomologists in place of the old rather cumbrous name of " surface caterpillars." They are the caterpillars of a group of nocturnal moths, and are generally root feeders, though they often come above the surface of the soil at night. The term " cut-worm " refers to a common habit they have of cutting off a plant at the ground level. The best known and most widely injurious species is the Turnip or Dart moth, *Euxoa (Agrotis) segetum.* The earth-coloured, fleshy caterpillars will attack almost any kind of crop, and during the summer of 1935 they were responsible for more injury than for many years past.

The most effective treatment is the use of the bran and Paris green poison bait. This was found to give satisfactory control in many cases during the past season.

Root Eelworm, Heterodera schachtii.—Early in the year, Mr. F. R. Petherbridge, of Cambridge, found cases of sugar beet injury by root eelworm. Further investigation showed that the pest was present to some extent in most sugar beet crops. In view of the serious amount of damage inflicted by this pest to sugar beet in the United States and on the Continent, the observation was very disquieting.

A peculiarity of eelworms of the genus *Heterodera* is that the female worms are not eel-like but resemble flasks in shape, and that when they have been fertilized they come out of the root into the soil and are then nothing but bags of eggs. These are called "cysts."

H. schachtii is known in England chiefly as a potato pest—indeed it is often called the potato eelworm—but the crops from which it has been reported are very numerous, including all the cereals as well as peas, beans, hops and even grape vines. In all these cases the worms appear to be just the same. The form which attacks potato cannot be distinguished under the microscope from that which injures sugar beet, but there are, nevertheless, differences in behaviour which lead us to regard them as different "strains" of the same species. The potato "strain" does not readily accustom itself to a beet diet, but will do so in time, and there is little doubt that in the cases of beet attack noted in England the disease was acquired from soil where potatoes had been grown for years.

The "cysts" are very minute bodies, only recognizable by an expert. They often adhere loosely to the outside of roots and tubers, and the possibility of their being introduced into gardens and allotments with seed potatoes has been pointed out more than once in these reports. Where potatoes have been grown for a long period the cysts may be found in incredible numbers in the soil, and the eggs in them are capable of remaining alive for a long but unknown period, variously estimated at from three to six years. Hitherto this pest has not been counted among the numerous enemies of the sugar beet crop, but this immunity does not seem likely to continue very long. We have, at all events, a vast amount of experience and research in other countries to draw upon, for both in the United States and in central Europe attention has been concentrated on the beetroot eelworm for a long time past. The Ministry of Agriculture and Fisheries is well aware of the importance of the matter, into which it is instituting a special enquiry. It is possible here to indicate only the chief lines of treatment adopted abroad, with, unfortunately, no very marked success. They are

(1) rotation, (2) the application of insecticides to the soil and (3) the use of trap crops. The trouble as regards rotation is, of course, the extremely long life of the eggs in the soil. Of the numerous substances which have been experimented with as soil dressings, sulphate of iron has met with some success. The idea of trap crops is to insert between two crops of sugar beet some plant which will attract the eelworm in the soil and which may then be ploughed up and destroyed.

GRASSLAND.

The insect enemies of grass were extraordinarily destructive during the past season. Failure was sometimes due to chafer grubs, but these were not more than normally abundant. The grass aphis, *Myzus festucæ*, however, which seldom does much harm, became a serious pest in Yorkshire and Lancashire,

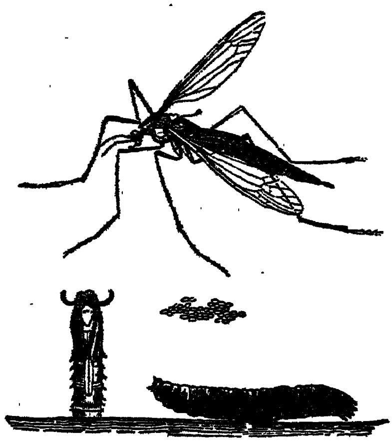

FIG. 2—*Tipula oleracea*, with eggs, larva and pupa.

especially, it was observed, on leys where an excessive amount of farm-yard manure had been used. Then the Antler moth, *Cheræas graminis*, whose rare occurrence almost resembles a visitation of locusts, made its appearance in Brecknockshire. Fortunately its depredations are generally confined to rough mountain pastures, and in the present instance no damage was done below a level of 1,700 feet.

Leatherjackets.—It was in grassland that "leatherjacket" injury was most marked.

Leatherjackets are, of course, among the most familiar agricultural pests, but the fact that they are often sent for indentification shows that they are by no means universally recognized when met with in gardens and allotments. In view

of their special destructiveness during the past year, and the great attention which their attacks on golf courses have attracted for several years past, it seems desirable to recapitulate the chief facts known about their life-history and treatment.

The great abundance of any pest in a particular year is no doubt due to a variety of circumstances, many of which are very obscure, though probably weather influences are the most important. These may favour the development of the pest, and at the same time discourage that of various creatures that normally prey upon it.

As mentioned in my Report for 1934, two circumstances led me to suggest that we might have trouble from leatherjacket in 1935. The first was the abnormal number of crane-flies noticeable in the late summer and early autumn, and the second was the absence of wasps—not very important perhaps, but not altogether negligible.

The life-history of the leatherjacket may be described very briefly.

Everyone knows that leatherjackets are the grubs of crane-flies or "daddy-long-legs," flies of a group scientifically known as Tipulidæ. There are many species, but it seems that two only are concerned in attacks of agricultural importance, *Tipula paludosa* and *T. oleracea*. These flies are mostly to be seen in the late summer and early autumn. They live only a very short time—a fortnight or so—but they mate at once on emergence, and the female very soon lays its eggs. As each female lays 400 or more eggs, the vast number of leatherjackets sometimes resulting need cause no surprise. Light sandy soil is preferred, and grassland offers an ideal supply of roots for the grubs to feed on. Hardly any crop, however, is immune, and during the past year they seriously injured cereals, roots, peas and strawberries as well as grass.

The eggs hatch in a fortnight, and the grubs are at first, of course, very small and very different in appearance from the familiar leatherjackets. They are too feeble to attack roots, and during the autumn they feed on *humus*—decaying vegetable matter in the soil. At this stage they are very susceptible to drought. A warm damp autumn favours them, while dry autumn weather is fatal to hosts of the first-stage larvæ. The larval condition lasts for about nine months, and during about six months the larvae are the well known slaty-brown legless grubs, with leathery skins, known as leatherjackets. In the summer, having now grown to a length of more than an inch, they cease feeding and pupate in the soil. The pupæ (or chrysalids) remain quiescent in the ground till the flies are ready to emerge. They then force the anterior portion above the ground, the skin splits and the flies emerge.

Treatment.

As grassland especially suffers from this pest it is not surprising that it has engaged the attention of those concerned with the upkeep of golf courses, and it is to the work of the Research Station at Bingley, set up by the Board of Greenkeeping Research, that any recent advance in methods of treatment is chiefly due; and it is to this station that the keepers of cricket grounds naturally turn for advice when troubled with leatherjackets, as was the case with Lord's cricket ground during the past season.

Some years ago it was accidentally discovered that if a grass plot was heavily watered and then left for the night covered by a tarpaulin, the leatherjackets came to the surface and could be collected the next morning. Obviously this treatment is impracticable for large areas, but the fact is worth noting. The grubs can, however, be induced to come to the surface by the application of various washes, and a great number of preparations have been experimented with which have this object in view. Jeyes' fluid (1 pint in 40 gallons water) has proved fairly effective. Dr. W. T. Evans of the Research Station has, however, obtained the best results from a preparation of the chemical orthodichlorobenzine with sodium oleate and Jeyes' fluid, and he kindly offers to supply any inquirer with full information as to where the ingredients may be obtained.

These measures are more appropriate for lawns and putting greens than for ordinary farm crops. Poison baits are here resorted to. One pound of Paris green is mixed with 40 lb. of bran, 2 gallons of water and a pint of treacle are added, and the whole is thoroughly stirred. This is distributed with the gloved hand, and suffices for an acre. Such applications should be used only when the weather is mild and damp, and the grubs are likely to be near the surface.

FRUIT.

The spring frosts did so much damage to fruit that insect injury was comparatively unimportant. Some aphis attacks were locally severe, especially on pear and cherry. Plum saw-fly was prevalent in East Anglia, and Apply saw-fly occurred rather abundantly in the west.

The raspberry beetle, *Byturus tomentosus*, was seldom complained of. It is hoped that the derris treatment adopted for the last few years is really proving an efficient control for this pest.

A feature of the year was the extreme abundance of the Codling moth.

Cydia pomonella, the Codling Moth.

No fruit pest is more familiar than the Codling moth, whose caterpillar is the grub so frequently found in apples. It is

always with us to some extent, but its special abundance appears to occur in cycles, and after some years of comparative unimportance it became this year almost everywhere a serious pest to an apple crop already depleted by frost. In many cases pears were also attacked.

The large fruit growers are, of course, perfectly acquainted with its life-history and treatment, but among owners of small orchards, and holders of allotments with a few fruit trees, I have found that there are many mistaken ideas with regard to this pest.

Briefly, its life-history is this. The eggs are laid in May on the young fruit. They are deposited singly on any part of the fruit, or sometimes on the leaves. They hatch in ten days and the minute caterpillars crawl into the crown or " eye " of the young apple or pear. Here they feed for some time before burrowing deeply. This is the period when an arsenic spray may be of some benefit; hereafter the caterpillar is entirely within the fruit and out of reach of any wash.

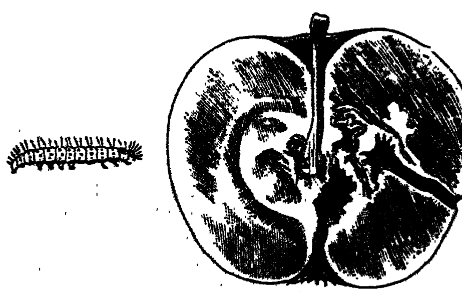

FIG. 3.—Codling moth caterpillar and injured apple.

The young caterpillar makes straight for the core on which it chiefly feeds, but it soon makes a tunnel to the side of the apple, out of which the " frass " continually oozes, and by which the full-grown grub leaves the apple. The apple may have fallen early on account of the injury, or the caterpillar may leave it and drop to the ground while the fruit is still on the tree. Its next proceeding is to find a retreat in which to spin a cocoon, and this is often supplied by loose bark and crannies in the trunk of old trees. The caterpillar in the cocoon does not turn to a chrysalis till the following spring, the moth appearing in late April or May. In a favourable season there may be two broods of the moth.

The small fruit grower is handicapped in his treatment of this pest by the fact that any measures he takes may be frustrated by negligence on the part of his neighbours. The moth can fly perfectly well, and it is disheartening to clear one's orchard and

have it re-infested from neglected trees in gardens near at hand. Two simple measures, if universally applied in a district, would soon have a marked effect in reducing Codling moth.

(1) Windfalls should not be allowed to remain on the ground but should be frequently gathered up and so dealt with that the caterpillars within them cannot crawl away to safety.

(2) Bands of hay or sacking, or of corrugated paper should be placed round the trunks in June and removed and destroyed in the winter. They act as a trap for the caterpillars, which find them a convenient shelter for spinning their cocoons.

There apparently exists among gardeners a widespread belief that this pest can be combated by means of *sticky* bands, such as are used against winter moth. Of course, such bands are of no avail against a moth so well equipped for flying as the Codling moth.

CECIL WARBURTON.

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Cambridge.

Royal Agricultural Society of England.

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1935	Dyott, Major R. A., *The Manor of Freeford, Lichfield* (*Staffordshire*).

* Nominated Member of Council.

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		—3,288	— 22	
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	London	400	2	John Bell; Sir A. G. Weigall.
	Nottinghamshire	166	1	Thomas Forshaw.
	Rutland	46	1	E. Guy Fenwick.
	Shropshire	253	1	E. Craig Tanner.
	Suffolk	349	2	Major Norman Everett; Fred Smith.
	Surrey	189	1	R. Borlase Matthews.
	Wiltshire	147	1	Earl of Radnor.
	Yorkshire, W.R.	272	1	C. W. H. Glossop.
	South Wales	75	1	Capt. H. A. Christy.
		—2,837	— 17	
C.	Berkshire	193	1	H. A. Benyon.
	Cambridgeshire	187	1	S. Owen Webb.
	Cumberland	134	1	Joseph Harris.
	Glamorgan	51	1	Hubert Alexander.
	Gloucestershire	267	1	Major C. C. Hansford.
	Huntingdonshire	27	1	Lord Eltisley.
	Kent	280	2	Thomas Neame; J. E. Quested.
	Lincolnshire	270	2	John Evens; Eustace Abel Smith.
	Oxfordshire	144	1	Robert Hobbs.
	Somerset	140	1	Robert Bruford.
	Sussex	304	2	Walter R. Burrell; Sir G. L. Courthope, Bart.
	Warwickshire	247	1	Col. C. J. H. Wheatley.
	Westmorland	75	1	Jacob Wakefield.
	Yorkshire, E.R.	95	1	T. L. Wickham-Boynton.
	Ireland	61	1	Edward Bohane.
	North Wales	191	1	Major W. Marshall Dugdale.
		—2,666	— 19	
Foreign Countries		196		*Viscount Bledisloe.
Members with no Addresses		17	6	*Sir W. C. D. Dampier.
				*Richard H. Evans.
Grand Totals		9,004	64	*A. C. Nicholson.
				*E. C. Ransome.
				*Sir John Russell.

* Nominated Members of Council.

TABLE SHOWING THE NUMBER OF GOVERNORS AND MEMBERS IN EACH YEAR FROM THE ESTABLISHMENT OF THE SOCIETY.

Year.	President of the Year.	Governors.		Members.			Total.
		Life.	Annual.	Life.	Annual.	Honorary.	
1839	3rd Earl Spencer	—	—	—	—	—	1,100
1840	5th Duke of Richmond	86	189	146	2,434	5	2,860
1841	Mr. Philip Pusey	91	219	231	4,047	7	4,595
1842	Mr. Henry Handley	101	211	328	5,194	15	5,849
1843	4th Earl of Hardwicke	94	209	429	6,155	15	6,902
1844	3rd Earl Spencer	95	214	442	6,161	15	6,927
1845	5th Duke of Richmond	94	198	527	5,899	15	6,733
1846	1st Viscount Portman	92	201	554	6,105	19	6,971
1847	6th Earl of Egmont	91	195	607	5,478	20	6,391
1848	2nd Earl of Yarborough	93	186	648	5,387	21	6,335
1849	3rd Earl of Chichester	89	178	582	4,643	20	5,512
1850	4th Marquis of Downshire	90	169	627	4,356	19	5,261
1851	5th Duke of Richmond	91	162	674	4,175	19	5,121
1852	2nd Earl of Ducie	93	156	711	4,002	19	4,981
1853	2nd Lord Ashburton	90	147	739	3,928	19	4,923
1854	Mr. Philip Pusey	88	146	771	4,152	20	5,177
1855	Mr. William Miles, M.P.	89	141	795	3,838	19	4,882
1856	1st Viscount Portman	85	139	839	3,896	20	4,979
1857	Viscount Ossington	83	137	896	3,933	19	5,068
1858	6th Lord Berners	81	133	904	4,010	18	5,146
1859	7th Duke of Marlborough	78	130	927	4,008	18	5,161
1860	5th Lord Walsingham	72	119	927	4,047	18	5,183
1861	3rd Earl of Powis	84	90	1,113	3,328	18	4,633
1862	H.R.H. The Prince Consort 1st Viscount Portman	83	97	1,151	3,475	17	4,823
1863	Viscount Eversley	80	88	1,263	3,735	17	5,183
1864	2nd Lord Feversham	78	45	1,343	4,013	17	5,496
1865	Sir E. C. Kerrison, Bart., M.P.	79	81	1,386	4,190	16	5,752
1866	1st Lord Tredegar	79	84	1,395	4,049	15	5,622
1867	Mr. H. S. Thompson	77	82	1,388	3,903	15	5,465
1868	6th Duke of Richmond	73	74	1,409	3,888	15	5,461
1869	H.R.H. The Prince of Wales, K.G.	75	73	1,417	3,864	17	5,446
1870	7th Duke of Devonshire	74	74	1,511	3,764	15	5,436
1871	6th Lord Vernon	72	74	1,589	3,896	17	5,648
1872	Sir W. W. Wynn, Bart., M.P.	71	73	1,655	3,953	14	5,768
1873	3rd Earl Cathcart	74	62	1,832	3,936	12	5,916
1874	Mr. Edward Holland	76	58	1,944	3,756	12	5,846
1875	1st Viscount Bridport	79	79	2,058	3,918	11	8,145
1876	2nd Lord Chesham	83	78	2,164	4,013	11	6,349
1877	Lord Skelmersdale	81	76	2,239	4,073	17	6,486
1878	Col. Kingscote, C.B., M.P.	81	72	2,328	4,130	26	6,637
1879	H.R.H. The Prince of Wales, K.G.	81	72	2,453	4,700	26	7,332
1880	9th Duke of Bedford	83	70	2,673	5,083	20	7,929
1881	Mr. William Wells	85	69	2,765	5,041	19	7,979
1882	Mr. John Dent Dent	82	71	2,849	5,059	19	8,080
1883	6th Duke of Richmond and Gordon	78	71	2,979	4,952	19	8,099
1884	Sir Brandreth Gibbs	72	72	3,203	5,408	21	8,776
1885	Sir Massey Lopes, Bart., M.P.	71	69	3,356	5,619	20	9,135
1886	H.R.H. The Prince of Wales, K.G.	70	61	3,414	5,569	20	9,134
1887	2nd Lord Egerton of Tatton	71	64	3,440	5,387	20	8,982
1888	Sir M. W. Ridley, Bart., M.P.	66	56	3,521	5,225	16	8,884
1889	HER MAJESTY QUEEN VICTORIA	73	58	3,567	7,153	15	10,866
1890	Lord Moreton	122	58	3,846	6,941	17	10,984
1891	2nd Earl of Ravensworth	117	60	3,811	6,921	19	10,928
1892	1st Earl of Feversham	111	69	3,784	7,066	20	11,050
1893	1st Duke of Westminster, K.G.	107	74	3,786	7,138	21	11,126
1894	8th Duke of Devonshire, K.G.	113	73	3,798	7,212	22	11,218
1895	Sir J. H. Thorold, Bart.	120	80	3,747	7,179	23	11,149
1896	Sir Walter Gilbey, Bart.	126	83	3,695	7,253	23	11,180
1897	H.R.H. The Duke of York, K.G.	126	83	3,705	7,285	24	11,223
1898	5th Earl Spencer, K.G.	121	79	3,687	7,182	25	11,094
1899	9th Earl of Coventry	116	75	3,656	7,009	23	10,879
1900	H.R.H. The Prince of Wales, K.G.	111	71	3,628	6,832	24	10,666
1901	3rd Earl Cawdor	102	70	3,564	6,338	27	10,033
1902	H.R.H. Prince Christian, K.G.	100	69	3,500	5,955	26	9,650
1903	H.R.H. The Prince of Wales, K.G.	99	62	3,439	5,771	27	9,398
1904	16th Earl of Derby, K.G.	96	68	3,375	5,906	32	9,477

Table showing the Number of GOVERNORS and MEMBERS in each year from the Establishment of the Society—*contd.*

Year.	President of the Year.	Governors		Members.			Total.
		Life.	Annual.	Life.	Annual.	Honorary.	
1905	9th Lord Middleton	89	78	3,212	5,758	33	9,170
1906	Mr. F. S. W. Cornwallis	94	155	3,132	6,189	30	9,600
1907	Earl of Yarborough	91	174	3,076	6,299	29	9,669
1908	Duke of Devonshire, K.G.	89	178	3,019	6,442	30	9,758
1909	7th Earl of Jersey, G.C.B.	91	177	2,951	6,696	31	9,946
1910	Sir Gilbert Greenall, Bart.	86	166	2,878	6,934	31	10,095
1911	His Majesty King George V.	85	168	2,805	7,191	30	10,279
1912	9th Lord Middleton	85	170	2,741	7,283	30	10,309
1913	2nd Earl of Northbrook	89	168	2,691	7,474	26	10,448
1914	Earl of Powis	89	173	2,626	7,629	28	10,545
1915	Duke of Portland, K.G. [K.G.	88	184	2,517	7,313	28	10,130
1916	7th Duke of Richmond and Gordon,	83	185	2,427	7,526	27	10,248
1917	Mr. Charles Adeane, C.B.	93	210	2,412	8,214	26	10,955
1918	Hon. Cecil T. Parker	102	224	2,395	8,226	25	10,972
1919	Sir J. B. Bowen-Jones, Bart.	119	236	2,411	8,558	24	11,348
1920	H.R.H. The Prince of Wales, K.G.	129	256	2,402	9,208	25	12,020
1921	Mr. R. M. Greaves	137	275	2,374	10,098	24	12,908
1922	H.R.H. The Duke of York, K.G.	144	287	2,317	10,596	22	13,366
1923	Lt.-Col. E. W. Stanyforth	153	293	2,262	10,778	20	13,506
1924	Mr. Ernest Mathews, C.V.O.	159	289	2,201	10,676	21	13,346
1925	Sir Gilbert Greenall, Bart, C.V.O.	158	291	2,160	10,949	15	13,573
1926	Lord Desborough, G.C.V.O.	155	276	2,103	10,251	15	12,800
1927	1st Viscount Tredegar, C.B.E.	153	257	2,035	9,343	15	11,803
1928	Lord Harlech, C.B.	155	277	1,972	9,042	16	11,462
1929	Earl of Harewood, K.G.	154	273	1,914	8,813	16	11,170
1930	H.R.H. The Duke of Gloucester, K.G.	158	264	1,882	8,491	16	10,811
1931	Sir Arthur Hazlerigg, Bart.	153	245	1,823	8,036	16	10,273
1932	Lord Mildmay of Flete	144	223	1,774	7,501	13	9,655
1933	Duke of Devonshire, K.G.	140	212	1,707	7,367	13	9,439
1934	Earl of Stradbroke, K.C.M.G.	140	205	1,666	7,141	17	9,169
1935	H.R.H. The Duke of Kent, K.G.	142	201	1,614	7,029	18	9,004

STATEMENT made to the Council by the Chairman of the Finance Committee, on presenting the Accounts for the year 1934.

MR. ADEANE said that the Council would notice that the form in which the Accounts were presented had been slightly changed. The object had been to simplify them as much as possible and to do away with unnecessary detail. So much of what was known as extra expenditure had become recurrent that there was no necessity to keep up the distinction between ordinary and extraordinary payments and receipts, and they had been brought together under the head of "Miscellaneous." In the Balance Sheet the "Debtor" side now opened with the details of the Capital and Reserve Fund; and Sundry Creditors had been put at the foot of the page. These changes, though slight, made it difficult to compare with the previous year's figures and so they had been omitted.

With regard to the receipts and payments a/c, the balance brought forward at the beginning of the year was £3,827. The receipts amounted to £18,290, giving a total of £22,117.

The ordinary receipts showed an increase of £280, due to additional income from investments; but there had again to be recorded a decline of £265 in subscription revenue, which was explained by loss of membership.

Owing to the great success financially of the Ipswich Show it was possible to invest from the ordinary account £3,500—the sum allocated against possible loss on the Show—and also £2,000 from the cash balances, £1,500 of which was brought forward from the previous year. These figures were included in the total payments, which amounted to £18,663. The balance of cash at bankers and in hand at the end of the year totalled £3,454.

With regard to the Balance Sheet the reserve fund investments showed an increase of £31,083 as compared with the previous year, due to appreciation in value of £17,584, and to additional cash invested during the year of £13,499.

The very large appreciation of the invested fund was due to the great rise of gilt-edged securities during the last two or three years, and could not be expected to go on indefinitely. Indeed, this appreciation might lead to a feeling of false security. To some it might seem unnecessary to build up so large a reserve, but, quite apart from the desirability of having a strong reserve for a Society of this importance, they must look to the income derived from the invested reserve to balance the serious falling off in the Society's income from membership. To illustrate this he gave the Council a few figures. In 1925—the peak year in regard to membership—the membership stood at 13,620; the corresponding figure in 1934 was 9,243, or a decrease of 4,377 members. On these figures the approximate annual loss in revenue from membership might be put at £3,600. The Invested Reserve Fund had increased from £121,406 at the end of 1925 to £231,671 at the end of 1934, but the gross income from investments and daily balances had only increased by £1,500 annually, that is, from £6,000 to £7,500.

The running yield per cent. on the total invested funds at the end of 1925 was £4 12s. 1d., but at the end of 1934 it was only £3 4s. 8d. So that, taking the two main sources of revenue together, that is, from subscriptions and investments, the Society was now annually considerably worse off as regards income than in 1925.

The financial position of the Society was satisfactory but the falling off in membership was a weak point and he again ventured to appeal to Members of the Council to do all they could to increase the Membership in their respective counties.

With regard to the Estimate for the coming year the receipts were expected to amount to £17,932 against an expenditure of £17,081.

Receipts.

	£	s.	d.	£	s.	d.	£	s.	d.
CASH AT BANKERS AND IN HAND, JANUARY 1, 1934 :—									
Reserve Fund Account				79	0	0			
Current Account				3,569	6	10			
Petty Cash at Bank and in Hand . . .				179	10	3			
							3,827	17	1
SUBSCRIPTIONS :—									
Annual Governors	1,121	17	0						
Annual Members	7,332	11	3						
Life Governors and Members . .	32	8	0						
For previous years . . .	58	10	0						
				8,545	6	3			
JOURNAL OF THE SOCIETY :—									
Advertisements	271	14	10						
Sales and Reprints . . .	128	15	6						
				400	10	4			
EXAMINATIONS :—									
National Diploma in Agriculture .	493	9	6						
National Diploma in Dairying .	399	12	5						
				893	1	11			
MISCELLANEOUS :—									
Interest on Investments . .	6,748	6	8						
Income Tax refunded . . .	189	1	7						
Bank Interest	47	9	5						
Sales of Pamphlets, etc. . . .	36	18	8						
Sales of Text Book . . .	201	7	10						
Hire of Rooms	32	11	0						
Donations to Society's Funds .	105	5	4						
Argentine Rural Society . .	100	0	0						
Park Royal Drainage Rate . .	151	16	1						
Rent, 12, Hanover Square . .	247	10	0						
				7,860	6	7			
TOTAL OF ORDINARY RECEIPTS							17,699	5	
Life Compositions of Governors and Members				464	19	0			
Subscriptions for 1935 . . .				117	2	0			
Amounts owing on December 31, 1933 :—									
Show Account				2	16	0			
Argentine Rural Society . .				5	12	0			
							590	9	
							£22,117	11	

Payments.

	£ s. d.	£ s. d.	£ s. d.
GENERAL ADMINISTRATION :—			
Salaries and Wages	4,089 19 3		
Pension to late Secretary (part cost)	358 12 11		
Legal Charges and Auditors' Fees	241 16 0		
Rent, Rates, Insurance and House Expenses	1,002 0 9		
Printing and Stationery	357 2 7		
Postage, Telephone and Sundries	306 2 1		
		6,355 13 7	
JOURNAL OF THE SOCIETY :—			
Volume 94	1,357 14 7		
Re Volume 95	26 14 8		
		1,384 9 3	
SCIENTIFIC DEPARTMENTS :—			
Chemist's Salary and Petty Cash	409 11 9		
Botanist's Salary	250 0 0		
Zoologist's Salary	200 0 0		
Grant to Royal Veterinary College	400 0 0		
Grant to Research Institute, Reading	50 0 0		
Medal *re* Cattle Pathology	2 11 9		
		1,312 3 6	
EXAMINATIONS :—			
National Diploma in Agriculture	602 4 4		
National Diploma in Dairying	533 14 2		
		1,135 18 6	
MISCELLANEOUS :—			
Grant to Research Fund	1,473 19 6		
Library : Books, etc.	21 4 9		
Repairs to House, etc.	25 2 1		
Medals, etc., for Long Service	3 12 7		
New Text Book : "Elements of Agriculture"	100 12 1		
Dinner to Secretaries of Breed Societies	86 4 1		
Donation to Stenhouse Williams Memorial Fund	20 0 0		
Donation to Rothamsted Experimental Station	500 0 0		
Gold Medal ; design, dies, etc.	81 2 0		
Argentine Rural Society	100 0 0		
Park Royal Drainage Rate	314 11 1		
Rent, 12, Hanover Square	247 10 0		
Amount set aside towards Loss on Shows (to Invested Reserve Fund)	3,500 0 0		
		6,473 18 2	
TOTAL OF ORDINARY PAYMENTS			16,662 3 0
Show Account : for Postage, etc.		0 19 1	
On Account of Investments purchased (ex Ordinary and Reserve Accounts)		2,000 0 0	
			2,000 19 1
CASH AT BANKERS AND IN HAND, DECEMBER 31, 1934 :—			
Reserve Fund Account		43 19 0	
Current Account		3,200 15 5	
Petty Cash at Bank and in Hand		209 14 8	
			3,454 9 1
			£22,117 11 2

3 FREDERICK'S PLACE,
OLD JEWRY, LONDON, E.C.2.
20th February, 1935.

Examined, audited and found correct,
PRICE, WATERHOUSE & CO.,
Chartered Accountants,
Accountants and Auditors.

Dr. BALANCE SHEET,

	£ s. d.	£ s. d.	£ s.
To CAPITAL AND RESERVE FUND—			
As at December 31, 1933 . .		208,620 13 0	
SHOW FUND—			
Surplus on Ipswich Show . .	8,228 13 8		
Add: Contribution from Ordinary Account	3,500 0 0		
		11,728 13 8	
		220,349 6 8	
RECEIPTS AND PAYMENTS ACCOUNT—			
Ordinary Receipts . . .	17,699 5 1		
Ordinary Payments . . .	16,662 3 0		
		1,037 2 1	
Life Compositions received in 1934		464 19 0	
Subscriptions for 1934 received in 1933		162 14 0	
		222,014 1 9	
Add: Appreciation in market values of Investments . . .		17,584 4 8	
		239,598 6 5	
Add: Adjustment *re* outstanding Assets and Liabilities . . .		339 9 10	
		239,937 16 3	
DEPRECIATION written off, viz.:—			
Furniture, Fittings, &c. . . .	38 8 8		
Show Plant	245 12 5		
Lease of 16, Bedford Square . .	100 0 0		
		384 1 1	
			239,553 15
To SUNDRY CREDITORS—			
Sundry Accounts owing . . .		2,123 15 0	
Subscriptions for 1935 received in 1934		117 2 0	
			2,240 17
			£241,794 12

NOTE—There are commitments in respect of Contracts entered into in connexion with the forthcoming Show.

T. B. TURNER,
Secretary.

	£ s. d.	£ s. d.
By RESERVE FUND INVESTMENTS—		
£154,609 4*s.* 11*d.* Conversion Loan 3½% (1961) @ 111*	171,616 5 4	
£3,909 16*s.* Local Loans 3% (1912) @ 97¼*	3,802 5 7	
£2,840 13*s.* 6*d.* Metropolitan 3% Consolidated Stock (1941) @ 105½*	2,996 18 3	
£6,528 1*s.* 6*d.* Dominion of Canada 4% Stock (1940–60) @ 107*	6,985 0 9	
£2,724 11*s.* 7*d.* Metropolitan Water 3% (E) Stock (1953–73) @ 101*	2,751 16 6	
£12,234 12*s.* 5*d.* Commonwealth of Australia 4% Stock (1955–70) @ 110	13,458 1 8	
£6,800 14*s.* 2*d.* Union of S. Africa 3½% Stock (1953–73) @ 107*	7,276 15 2	
£6,500 Dominion of Canada 4% Stock (1953–58) @ 113*	7,345 0 0	
£11,371 18*s.* Commonwealth of Australia 3¾% Stock (1946–49) @ 105*	11,940 9 11	
£3,430 Central Electricity Board 3½% Stock (1963–93) at 102*	3,498 12 0	
*Market value at December 31, 1934.		231,671 5 2
By LEASE OF 16, BEDFORD SQUARE	300 0 0	
Less Amount written off in 1934	100 0 0	
		200 0 0
By FURNITURE, FITTINGS, FIXTURES, Etc.—		
As at December 31, 1933	384 6 6	
Less Depreciation at 10%	38 8 8	
		345 17 10
By PICTURES (£500) and BOOKS (£1,000)		1,500 0 0
By SHOW PLANT—		
As at December 31, 1933	2,456 3 11	
Less Depreciation at 10%	245 12 5	
		2,210 11 6
By EXPENDITURE (less amounts received or due) *re* NEWCASTLE-ON-TYNE SHOW		1,893 2 4
By SUNDRY DEBTORS		2,892 14 9
By RATES PAID IN ADVANCE AND INCOME TAX RECOVERABLE		237 7 6
By CASH AT BANKERS AND IN HAND—		
Reserve Fund Account	43 19 0	
Investment Account	229 9 11	
Current Account	3,200 15 5	
Petty Cash at Bank and in Hand	209 14 8	
	3,683 19 0	
Less SHOW ACCOUNT—Overdrawn	2,040 5 11	
		1,643 13 1
		£241,794 12 2

Examined, audited and found correct,
PRICE, WATERHOUSE & CO.,
Chartered Accountants,
Accountants & Auditors.

3 FREDERICK'S PLACE,
OLD JEWRY, LONDON, E.C.2.
20th February, 1935.

Royal Agricultural Society of England.

STATEMENTS OF FUNDS HELD BY THE SOCIETY IN TRUST OR WHICH ARE NOT CONSIDERED AVAILABLE FOR GENERAL PURPOSES, DECEMBER 31, 1934.

E. H. Hills' Bequest.

	£	s.	d.	£	s.	d.
To amount bequeathed for Pot-culture Experiments				9,000	0	0
Less : Depreciation of Consols at time of conversion	3,582	7	11			
„ Cost of conversion	134	14	7			
				3,717	2	6
				5,282	17	6
To surplus on sale of 5% War Loan Stock				333	4	4
				£5,616	1	10

	£	s.	d.
By £7,222 15*s.* 0*d.* 3½% Conversion Loan Stock (1961) (purchased on sale of War Loan Stock) at cost (*Value December* 31, 1934, at 111 = £8,017 5*s.*)	5,616	1	10
	£5,616	1	10

Queen Victoria Gifts Fund.

	£	s.	d.
To Fund originally invested (the income from this Fund is used to make Annual Grants to unsuccessful applicants for pension through the Royal Agricultural Benevolent Institution)	5,000	0	0
Less : Loss on sales of stocks	110	18	0
	4,889	2	0
Undistributed income and bonus	107	4	8
	£4,996	6	8

	£	s.	d.
By Investments in names of Trustees : at cost :			
£1,045 19*s.* 3*d.* Dominion of Canada 3½% Registered Stock, 1950–55	1,017	7	0
£2,046 11*s.* 8*d.* Commonwealth of Australia 3½% Registered Stock, 1954–59	2,099	18	10
£1,000 London Midland & Scottish Railway Consolidated 4% Guaranteed Stock	1,556	15	9
£190 4*s.* 6*d.* 2½% Consols	215	0	5
	4,889	2	0
By Cash at Bank, December 31, 1934	107	4	8
	£4,996	6	8

The market values of the Stocks on December 31, 1934, amounted to £4,453 12*s.* 4*d.*

STATEMENTS OF FUNDS HELD BY THE SOCIETY IN TRUST—*continued.*

Gilbey Fund.

	£ s. d.	£ s. d.		£ s. d.
To Amount provided by the late Sir Walter Gilbey for endowment of Lectureship at Cambridge University		1,000 0 0	By Investment at cost :— £1,457 5*s*. 2*d*. Metropolitan Water "A" Stock	1,204 10 4
Accumulation of Interest		204 10 4	(*Value on December* 31, 1934, at 98=£1,428 2*s*. 3*d*.)	
		£1,204 10 4		£1,204 10 4

Superannuation and Insurance Fund.

	£ s. d.	£ s. d.		£ s. d.
To amount set aside in accordance with declaration of Trust of July 26, 1911		9,171 5 0	By Investments in names of Trustees, at cost :—	
Less : Depreciation of Consols on conversion	1,837 18 4		£9,028 0*s*. 7*d*. 3½% War Loan Stock (1952) (converted from 5% Stock, July, 1932.)	8,453 7 8
" Cost of conversion	256 3 0		£728 2*s*. 4*d*. West Australian 3½% Stock (1935–55)	559 17 4
		2,094 1 4	£717 14*s*. 4*d*. Queensland 3½% Stock (1950–70)	541 15 6
		7,077 3 8		9,555 0 6
Add : Purchase of £1,367 14*s*. 9*d*. 5% War Loan Stock at cost		1,167 0 0	By Cash at Bank, December 31, 1934	132 18 0
		8,244 3 8		
Accumulation to Dec. 31, 1933		1,603 19 3	(Note.—The market values of the Stocks on Dec. 31, 1934, amounted to £11,285 8*s*. 11*d*.)	
Income for 1934	354 16 2			
Less : Premiums and Grant, Income Tax and share of pension	286 7 1			
		68 9 1		
		9,916 12 0		
Income Tax on War Stock Interest		71 6 6		
		£9,987 18 6		£9,987 18 6

"Merchants of the Staple of England" Fund.

	£ s. d.		£ s. d.
To capital sum paid by the "Merchants of the Staple of England" for the purpose of providing out of the yearly income Prizes to be competed for annually in the Wool Section of the Royal Show	500 0 0	By Investment at cost :— £503 1*s*. 9*d*. New South Wales Government 5% Inscribed Stock, 1935–55	500 0 0
		(Value on Dec. 31, 1934, at 103 = £518 3*s*. 7*d*.)	

Examined, audited and found correct,
PRICE, WATERHOUSE & CO.
Chartered Accountants,
Accountants & Auditors.

3 Frederick's Place,
Old Jewry, London, E.C.2.
20th February, 1935.

Royal Agricultural Society of England.

RESEARCH COMMITTEE.

RECEIPTS AND PAYMENTS FOR YEAR 1934.

RECEIPTS	£	s.	d.
To Grant from General Account . . .	1,473	19	6
	£1,473	19	6

PAYMENTS.	£	s.	d.
By Grants to Research Institute in Animal Pathology, Royal Veterinary College, for Research *re* Mastitis in Cows . . .	300	0	0
" Grants to Rothamsted Experimental Station for:—			
Lucerne Seed Inoculation Experiments .	50	0	0
Electricity on the Farm Investigation .	200	0	0
Collating Woburn Farm data . . .	250	0	0
" Grant to Norfolk Agricultural Station for disposal of Sugar Beet By-Products . .	300	0	0
" Editing, etc.	20	0	0
" *Farmer's Guide to Agricultural Research in* 1933 :—			
Honoraria to Contributors . . .	350	0	0
" Duplicating	3	19	6
	£1,473	19	6

3 Frederick's Place,
Old Jewry, London, E.C.2.
20th February, 1935.

Examined, audited and found correct,
PRICE, WATERHOUSE & CO.,
Chartered Accountants,
Accountants & Auditors.

STATEMENT made to the Council by the Chairman of the Finance Committee, on presenting the Audited Accounts of the Newcastle Show, 1935.

Mr. ADEANE stated that although the surplus on the Newcastle Show appeared in the Accounts as £6,505 the Society would not benefit to that extent. Just before the last meeting of the Council the Secretary had received a communication from the Town Clerk to say that the Local Show Fund was short by a large amount of the sum required to meet the expenses incurred in connection with the Show, and that he trusted the Council of the Society would be prepared to bear such of the local cost as had not been provided for by the Fund. That, he (Mr. Adeane) confessed, had been news of a startling nature. The accounts had been passed for audit by the Finance Committee and the authority of the Council had been asked for the investment of £6,000 of the surplus. When he had heard of the dilemma he had taken upon himself the responsibility of investing only £4,000 of the surplus, thus keeping £2,000 free to meet the emergency. He hoped the Council would endorse his action in that respect. (Hear, hear.) Since then he had, in conjunction with the Hon. Director of the Show, had an interview with the Town Clerk of Newcastle, who had explained fully the difficulties which the Local Committee had had in raising the required amount, owing to the depressed state of the North-east of England. The ascertained deficit was £1,950, and the Finance Committee, having considered the matter very carefully, asked the Council to make a grant of that amount to the Local Committee to relieve them of any anxiety. There was no legal claim on the Society whatever. Newcastle, as all the members knew, had always been a great friend of the Society—(Hear, hear)—and the Society had always had successful Shows in that city. He was sure, therefore, that the Council would wish to act generously in the matter. (Hear, hear.)

Turning to the Accounts, it would be remembered that last year the Committee had been unable to give comparative figures for the previous Show owing to the slight alteration in the manner of presenting the Accounts. This year, however, they were able to give the figures for the Ipswich Show as well as the Newcastle Show. The fees for Live Stock were down by £1,211, owing to the reduced entry, but that was balanced by the reduction in the cost of shedding. The Gate showed an increase of £1,728. On the Expenditure side there was nothing special to remark. Newcastle had always given the Society a warm welcome, and the Gate had been really remarkable when it was considered how great the depression there had been, and he feared still was, in the North-east and Tyneside. In 1923, 186,510 people had paid for admission. This year the Gate had been 133,520. There was no doubt that the Society's success in that direction had been very largely due to the presence of their President, H.R.H. the Duke of Kent, and their only regret was that His Royal Highness had been unable to be accompanied by the Duchess—a pleasure which it was to be hoped was reserved for another time. The Society tendered its warmest thanks to His Royal Highness for presiding over it during his year of office. The grateful thanks of the Council must be accorded to all those who had helped to make the Newcastle Show a success—to Lord Allendale and the Lord Mayor of Newcastle for their work as President and Chairman of the Local Executive Committee; to the Town Clerk, who had the unique record of having acted as Hon. Secretary of the Local Committee on three occasions when the Show had visited Newcastle; to Mr. Deans Forster and Captain Embleton, the Hon. Treasurers; to Mr. Oswald McBryde and Mr. F. Marshall, the Secretaries of the Northumberland and Durham Agricultural Societies, who had so kindly undertaken the Publicity work. Mr. Andrews, the Chairman of the Freemen of the Town Moor, the City Engineer and his staff, had also rendered invaluable help in the preparation of the site. Mr. C. H. Sample and Mr. William Burkitt (whose loss would long be felt by the Society), the representatives on the Council for Northumberland and Durham, had assisted with their local knowledge and had given ungrudgingly of their time to attend committees, and had helped in arranging many details in connection with the Show. Then they were, as always, greatly indebted to their Hon. Director, Mr. Burke—(Hear, hear)—who never spared himself in anything connected with the Show. He feared that Mr. Burke must have had a very tiring year owing to the distance to Newcastle. They were also much indebted to their Secretary, Mr. Turner, for his able management—(Hear, hear)—and to every member of the staff (Hear, hear).

STATEMENT OF RECEIPTS AND EXPENDI-

JULY 2 to

Figures for 1934 Show £	Receipts	£	s.	d.	£	s.	d.
2,000	Contribution from Newcastle-upon-Tyne Local Committee to Show Fund . .				2,500	0	0
	CONTRIBUTIONS TO PRIZE FUND :—						
2,707	Agricultural and Breed Societies and others	2,600	3	3			
1,550	Newcastle-upon-Tyne Local Committee	–	–	–			
4,257					2,600	3	3
11,348	FEES FOR IMPLEMENTS, MACHINES AND MISCELLANEOUS EXHIBITS . . .				10,814	1	5
	FEES FOR ENTRY OF LIVE STOCK :—						
7,453	Members	6,184	15	0			
444	Non-members	501	10	0			
7,897					6,686	5	0
207	FEES FOR ENTRY OF POULTRY AND EGGS				183	8	0
	OTHER ENTRY FEES :—						
94	Produce	103	16	0			
112	Horse-jumping Competitions . .	90	0	0			
29	Plantations Competition . . .	28	4	0			
22	Butter-making Competitions . .	35	15	0			
257					257	15	0
	CATALOGUE :—						
958	Advertising in Catalogue and extra lines	856	16	7			
902	Sales of Catalogue	959	19	4			
52	Sales of Daily Programmes . .	51	0	3			
1,912					1,867	16	2
	ADMISSIONS TO SHOWYARD :—						
1,107	Tuesday, July 2, @ 5*s*.	1,279	14	3			
4,372	Wednesday, July 3, @ 5*s*. and 3*s*. .	4,752	15	5			
5,184	Thursday, July 4, @ 3*s*.	5,689	8	7			
2,307	Friday, July 5, @ 2*s*. 6*d*.	2,386	9	5			
828	Saturday, July 6, @ 1*s*.	2,177	18	7			
234	Season Tickets	357	3	1			
1,593	Day and other Tickets	710	7	4			
15,625					17,353	16	8
£43,503	Carried forward . .				£42,268	5	[illegible]

TURE OF THE SHOW AT NEWCASTLE-UPON-TYNE'
JULY 6, 1935.

Figures for 1934 Show £	Expenditure	£ s. d.	£ s. d.
	COST OF ERECTION AND MAINTENANCE OF SHOWYARD :—		
2,748	Transferring Society's permanent buildings from Ipswich and re-erecting at Newcastle-upon-Tyne	3,051 6 7	
563	Fencing round Showyard	720 7 9	
1,989	Implement Shedding	1,859 15 9	
6,171	Stock Shedding	5,062 19 10	
2,068	Grand Stand, Offices, Rings, Signs, etc.	2,491 13 7	
845	General Labour and Horse Hire	863 8 3	
160	Hire of Sleepers	111 10 4	
2,276	Hire of Canvas	2,076 17 0	
			16,237 19 1
16,820			
	SURVEYOR :—		
675	Salary, Travelling and Sundry Expenses	667 9 9	
298	Clerk of Works: Salary and Travelling	286 16 5	
			954 6 2
973			
	PRINTING :—		
599	General Printing, Prize Sheet, Tickets, etc.	603 14 11	
921	Catalogue, Award Lists and Jumping Programmes	1,187 13 0	
			1,791 7 11
1,520			
	ADVERTISING :—		
580	Newspaper Advertising	848 16 10	
310	Billposting and Window Cards, etc.	379 10 4	
117	Advertisement Boards	93 19 3	
			1,322 6 5
1,007			
197	POSTAGE, CARRIAGE, ETC.		207 16 3
12,372	AMOUNT OF PRIZES AWARDED (including £2,600 3s. 3d. given by various Societies and others—per contra).		12,409 8 3
1,102	FORAGE FOR LIVE STOCK		716 7 2
591	JUDGES OF STOCK: FEES AND EXPENSES		639 15 9
£34,582	Carried forward		£34,279 7 0

Statement of Receipts and Expenditure

Figures for 1934 Show £	Receipts (contd.).	£ s. d.	£ s. d.
43,503	Brought forward . .		42,263 5 6
	ADMISSIONS TO GRAND STAND :—		
840	Reserved Seats	1,123 7 9	
1,092	Unreserved Seats	1,290 0 6	
1,932			2,413 8 3
	MISCELLANEOUS RECEIPTS :—		
1,505	Admissions to Flower Show . .	1,361 15 8	
2,108	Motor Parks	1,301 18 0	
111	Rent for Railway Offices	92 10 0	
500	Premium for Catering	400 0 0	
55	Premium for Cloak Rooms	50 0 0	
170	Rent for Ministry of Agriculture Pavilion	170 0 0	
210	Advertisements in Stock Prize Sheet .	150 8 10	
181	Sales of Produce at Dairy . .	140 14 1	
3	Ipswich Show :—outstanding items .	13 16 10	
52	Sundry Receipts	6 12 9	
4,895			3,687 16 2
£50,330			£48,364 9 11

Examined, audited, and found correct this 22nd day of November, 1935.

T. B. Turner, Secretary.

Price, Waterhouse & Co., Chartered Accountants.

OF THE SHOW AT NEWCASTLE-UPON-TYNE (*continued.*)

Figures for 1934 Show £	Expenditure (*contd.*).	£ s. d.	£ s. d.
34,582	Brought forward . .		34,279 7 0
	GENERAL ADMINISTRATION :—		
197	*Honorary Director* :—Travelling, Entertaining, etc.	262 19 3	
336	*Stewards and Assistants* :—*Stock, Hospitality and Implements* :—Personal and Railway Expenses	301 0 0	
662	*Secretary and Staff* :—Travelling, Maintenance, etc.	669 5 8	
630	*General Management* :—Finance Stewards, Grand Stand Men, Turnstile Men, Bank Staff, £257 0*s.* 5*d.*; Catalogue Sellers, £83 12*s.* 4*d.*; Foremen and Yardmen, £198 11*s.* 6*d.*; Gatekeepers, £147 2*s.* 1*d.*; Commissionaires, £22 8*s.* 7*d.*	708 14 11	
132	*Veterinary Department* :—Inspectors .	128 2 5	
162	*Engineering Department* :—Consulting Engineer	192 2 8	
486	Police	476 11 0	
			2,738 15 11
2,605			
	GENERAL SHOWYARD AND MISCELLANEOUS EXPENSES :—		
1,301	*Dairy* :—Building, £454 4*s.* 2*d.*; Steward, Assistants and Staff, £293 11*s.* 3*d.*; Milk, £209 1*s.* 6*d.*; Utensils, £73 10*s.* 0*d.*; Engine and Engineers, £115 15*s.* 8*d.*; Miscellaneous, £77 9*s.* 4*d.* . .	1,223 11 11	
567	*Poultry and Produce* :—Buildings, £353 11*s.* 3*d.*; Miscellaneous, £185 10*s.* 0*d.*	539 1 3	
704	*Flower Show* :—Hire of Tents, etc., £439 2*s.* 11*d.*; Miscellaneous, £249 8*s.* 10*d.*	688 11 9	
82	*Motor Parks* :—Tents, Offices, etc. .	37 16 6	
139	Plantations Competition . . .	84 14 0	
235	Forestry :—Tent and Miscellaneous .	195 11 8	
453	Military Display	705 18 0	
216	Band	274 9 9	
263	Hire of Furniture	245 11 4	
121	Royal and Official Luncheons . .	116 9 7	
80	St. John Ambulance	50 0 0	
94	Insurance	95 14 0	
70	Medals and Expenses *re* Cups . .	68 0 11	
112	Badges and Rosettes	98 7 5	
60	New Implements :—Testing and Medals	40 10 11	
67	Ipswich Show :—outstanding items .	6 4 10	
350	Sundry expenses	369 19 0	
			4,840 12 10
4,914			
42,101			41,858 15 9
8,229	Credit balance		6,505 14 2
£50,330			£48,364 9 11

Proceedings at General Meeting of Governors and Members

HELD IN THE LARGE TENT IN THE NEWCASTLE SHOWYARD,

THURSDAY, JULY 4th, 1935,

H.R.H. THE DUKE OF KENT, K.G., K.T. (PRESIDENT), IN THE CHAIR.

H.R.H. THE PRESIDENT, who was accorded an enthusiastic welcome on rising, said :—

My Lords, Ladies and Gentlemen,—It is a great pleasure to me to be here to-day in my position as President and to take the Chair at this Annual General Meeting of Members of the Royal Agricultural Society of England on the occasion of the Annual Show.

This is the sixth time the Show has been held at Newcastle, a record in itself, for no other town or city in the country can claim to have entertained the Society so often.

I imagine the Show has grown out of all recognition since it was first held in Newcastle in 1846, and if time allowed it would be interesting to recall the gradual expansion and changes that have taken place successively at the 1864, 1887, 1908, 1923 and 1935 Shows held in this city.

I am not going to weary you with figures, but just by way of contrast I find that in 1846 three distinct breeds of Cattle and four distinct breeds of Sheep were exhibited, with a total of 183 Cattle, 303 Sheep, 54 Agricultural Horses, and 92 Pigs. Passing over the intervening years during which so much has been done by Pedigree Stockbreeders in this country, fostered by the Royal Agricultural Society, we find that at the Show to-day classes are provided for no less than 12 breeds of Horses and Ponies, 19 breeds of Cattle, 26 breeds of Sheep and 11 breeds of Pigs, to say nothing of the Poultry, etc. The entry in these classes is : Horses, 644 ; Cattle, 1,060 ; Sheep, 684 ; Pigs, 593 ; so that those who are fond of figures may go away and analyse them for themselves. But whatever the result, one cannot ignore the immense strides made in the breeding and perfecting of the live stock in this country.

Having given you these figures, may I ask one question—What would be the use of all this expenditure of time, labour, and money, if Shows such as you see here to-day did not provide the "shop window" in which exhibitors can display the results of their efforts? To those efforts the Society at this Show offer no less than £16,000 in prize money.

In 1923, my brother, the Prince of Wales, speaking at this General Meeting, said he could congratulate the successful exhibitors and sympathise with the unsuccessful ones from his own personal experience as an exhibitor of live stock. I am afraid I cannot say the same words, but I do wish to congratulate all those who have taken prizes for the very fine animals at this Show.

So much for the Live Stock section, but there is the equally important Implement and Machinery section, together with the Seeds, Feeding Stuffs, etc. This occupies a very large area of the showyard, and gives even a novice the idea of what progress has been made in recent years in labour-saving devices and mechanised farming. The exhibitors in this section display their latest inventions before you in a fashion that would be bewildering in a less compact and well laid out Show.

There are, of course, many other sections of equal importance, just as interesting as the Live Stock and Machinery sections. There is the magnificent Flower Show, the Working Dairy with its daily competitions of Buttermakers, the Forestry section, the Horse-shoeing, and the special exhibits staged by the Armstrong College dealing with Agricultural Education and Research, and that of the North Eastern Electric Supply Company showing the great strides made in the harnessing of electricity to all branches of agriculture. I cannot describe these at length, and can only express the hope that you will visit them and see the exhibits for yourselves.

We owe a debt of gratitude to the County Agricultural Societies of Northumberland and Durham for withholding their shows this year.

The site of the Show is one of the best in England, and this has been freely placed at our disposal by the City Corporation and the Stewards and Freemen of the City. I am not going to say more about this, because a later speaker will tell you in more detail all about the work done in the preparation of the site and the help, financial and otherwise, given to the Society by the city and the adjacent counties.

My family have had a very long association with the Royal Agricultural Society of England (applause). I am very proud to be your President in the year of my father's Silver Jubilee (applause).

May I conclude with the earnest wish that the attendance at the Show this year will equal all previous records made by Newcastle-upon-Tyne, and that when the financial result of the Show is made known we shall all have reason to congratulate ourselves and say that Newcastle has more than lived up to its reputation on this occasion (applause).

Thanks to Lord Mayor and Corporation, Local Committee, and Stewards and Wardens of the Freemen of Newcastle.

The Duke of Devonshire said he had the honour and privilege to move: "That the best thanks of the Society are due and are hereby tendered to the Lord Mayor and Corporation, the Committee, Stewards and Wardens of the Freemen of Newcastle-upon-Tyne, and the Local Committee, for their cordial reception of the Society and their efforts to promote the success of the Show."

It would—His Grace said—be a great privilege to anyone to move that resolution, but to him it was especially an honour as he had so many very happy and pleasant recollections of the Show held there in 1908 when he was President of the Society (applause). It might, perhaps, be a little invidious to mention any names at that meeting, but he felt that they should place on record a reference to a few of those who had specially identified themselves with the holding of this year's very successful Show.

In the first place, he desired on behalf of the Society especially to thank the Lord Mayor and Corporation, who had done everything possible to further the success of the Show. The Society owed a debt of gratitude to the Stewards, Wardens and Freemen of Newcastle for providing such a splendid site. Mr. Andrews, Chairman of the Freemen, had been extremely helpful and had improved the ground for the Show. The Town Clerk of Newcastle was again acting as Local Secretary. That gentlemen had the unique distinction of having acted in that capacity for three Royal Shows, and he felt sure that on this occasion members of the Royal Agricultural Society would wish to add their sincere congratulations to the Town Clerk on the honour recently bestowed upon him. If he might be allowed to say so, His Grace thought the honour well deserved.

His Royal Highness had referred to the successful Shows previously held in Newcastle. His Grace thought he was right in saying that the Town Clerk not only held the record of being Local Secretary to three Royal Shows, but to three of the most successful Shows in the long history of the Society.

They also wished to thank Lord Allendale, who had been a most energetic President of the Local Committee (applause), and also Mr. Deans Forster and Councillor Embleton, joint Hon. Treasurers, for their untiring efforts to raise money for the Local Fund.

Probably, said His Grace, there were many present who could look forward 15 or 20 years to the time when the great city of Newcastle would again extend an invitation to the Royal Agricultural Society to hold another Show in their city, and he felt sure that past history of the cordial relations between the Royal Agricultural Society and Newcastle would form an admirable precedent when the time came round again. In the archives would be found all information as to what had been done by the Lord Mayor and the Corporation. Turning to the Lord Mayor, His Grace expressed the hope that on the occasion of the Society's next visit His Lordship might be in the same position as he was occupying that day. But, whoever then filled the position, His Grace said, he would only have to consult the records to find admirable precedents to go on.

As members of the Royal Agricultural Society, they all looked forward to the holding of the Show in different parts of the country. They would retain the happiest memories of their visits to Newcastle, and they wished to take that opportunity of expressing their grateful thanks not only to the Lord Mayor and the Corporation, but to all others who had taken so active a part in making the Show such a success. His Grace hoped they would accept the vote of thanks as one not made in a perfunctory manner, but as a heartfelt expression of the Society's grateful acknowledgments for making the Newcastle Show the success it always had been (applause).

Mr. Burke expressed his pleasure at being asked to second the motion. Having, as Honorary Director, been so closely associated with everybody in Newcastle and the surrounding district, and knowing all those who had worked so hard for the Show, he felt that he was in the happy position to endorse all that had been said by the Duke of Devonshire in proposing the resolution.

He would like to add the names of two gentlemen who had been a very great help. It would be known to all those present that the Northumberland and Durham Agricultural Societies had very kindly suspended their Shows on this occasion, and the Royal Agricultural Society had had the services of Mr. McBryde and Mr. Marshall, the Secretaries of the two County Societies. He could not tell the meeting how very highly they appreciated their most valuable assistance.

Might he also add the Society's grateful thanks for all that had been done by the Press of Newcastle and the surrounding counties. They had given the Show splendid publicity; and, if the Show proved to be the success they all hoped it would be, it would be largely due to the way the Press had helped them.

Finishing his remarks on a personal note, Mr. Burke thanked every one who had backed him up in carrying out his duties as Honorary Director of the Newcastle Show.

The Resolution was then put to the meeting by the Duke of Devonshire, and carried with acclamation.

The Lord Mayor of Newcastle (Councillor R. Stanley Dalgliesh) thanked the Duke of Devonshire, Mr. Burke and the Members of the Society for the very kind vote of thanks. He wished also to thank His Royal Highness for the kind remarks he made about the City of Newcastle. He was very glad that the city had kept up its reputation. Everybody had worked loyally to make the Show a thorough success, and he would convey with pleasure this vote of thanks at the City Council meeting on Wednesday to the Council and

to their Town Clerk and staff. Mr. Steel, the City Engineer, and his assistant should be specially mentioned, for they had really done all the "donkey work."

He was sorry that the local fund had not come up to the fullest expectations, but he was still hoping that before they finished they would have a larger amount of subscriptions to hand over to the Royal Show.

Mr. J. R. Andrews (Chairman of the Freemen) said that a year ago he told his colleagues that it would cost thousands of pounds to improve the site for the Royal Show, and they readily agreed to the expenditure.

They were proud and happy to see their great Town Moor used for such public and educational purposes, and he assured the Society that they would do all they could to see that when the local fund was concluded there was no deficit (applause).

He had already made a suggestion that improvements of a permanent character should be made to the site, and that the work should be done at the cost of the Freemen.

In conclusion, he expressed the hope that the result of that great Show would be even better than that of 1923.

Viscount Allendale also acknowledged the vote of thanks on behalf of the Local Committee. It was always a great occasion when the "Royal" came to Newcastle, he said, and they regarded it as a great privilege to receive the "Royal" there.

This year found them, agriculturally and industrially, in a very different position from 1923, when the Show was last there, with the result that people found it impossible to do now what was done then, but he thought all would agree that the attendance figures showed that the keenness and enthusiasm of the people up there still existed, and he had every hope that at the end it would be found that this Show had proved a great success.

They would very cordially extend an invitation to the "Royal" to visit Tyneside again, and he hoped they would find the district in a more prosperous condition than it was to-day.

Thanks to Railwaymen.

Mr. John Bell then moved: "That the best thanks of the Society are due and are hereby tendered to the Staff of the London & North Eastern Railway Company for all the work they have done in handling so expeditiously the traffic to the Show."

As Steward of Implements, he said, he would like to add that he had never known the traffic handled better or the implements and machinery delivered quicker.

Mr. John Evens, in seconding, said that once or twice he had appeared before the Railway authorities on behalf of the Royal Agricultural Society. He was rather sorry to say that the heads of departments had not granted all they had asked for. Perhaps it was not good for them. Anyway, they had been given a sympathetic hearing, and he was delighted to have the opportunity of supporting this resolution.

The vote of thanks was unanimously accorded.

Member's Suggestion.

In response to an enquiry from the Chair,

Mr. William Everall (Shrewsbury) asked the Council seriously to consider the reintroduction of the Farm Prize Competition. Speaking as an old competitor, he said that, in his opinion, nothing the Society could do would be more valuable.

H.R.H. THE PRESIDENT said that a note had been made of the suggestion, which would receive the attention of the Council.

Thanks to His Royal Highness.

Mr. ROBERT HORNSBY (Silloth, Cumberland) moved a hearty vote of thanks to H.R.H. the Duke of Kent for his services in the Chair and for his great interest in the Society. They all appreciated His Royal Highness's presence at the Show and they looked forward to his increasing interest in agriculture, not only in this country but in the Dominions. He had had the honour, curiously enough, of proposing a similar vote to His Royal Highness's brother in Australia, when he was on a recent visit to the Dominions.

Mr. HORNSBY, in conclusion, hoped that His Royal Highness might have the opportunity of attending as many Royal Shows as he had himself.

Mr. R. S. WALTERS (Warwickshire) seconded the motion. As a Member from some considerable distance, he said he was only too pleased to congratulate His Royal Highness on such a successful Show, "a Show more successful than we strangers anticipated." In doing so, he would like to express the gratitude of Members to His Royal Highness for the kindly interest he had taken in the work of the Society this year and particularly for attending the Show.

The vote of thanks having been passed with acclamation,

H.R.H. THE PRESIDENT, in acknowledging the vote, said that there was present that morning the Mayor of Wolverhampton, to whom he offered a welcome on behalf of the Society.

His Royal Highness said he had to announce that the Council had that morning accepted an invitation to hold the Show of 1937 at Wolverhampton. He felt that he could recommend Wolverhampton as he had spent part of his honeymoon "a very few miles away."

Proceedings at the Annual General Meeting of Governors and Members

HELD AT THE ROYAL AGRICULTURAL HALL, ISLINGTON, LONDON, N.,

WEDNESDAY, DECEMBER 11th, 1935,

THE DUKE OF DEVONSHIRE, K.G. (Trustee), IN THE CHAIR.

The CHAIRMAN: My Lords, Ladies and Gentlemen, in the much regretted absence of His Royal Highness The Duke of Kent, our President, I have been chosen by the Council to take the Chair at this our Annual Meeting. I propose to open the proceedings by asking the Secretary to read some remarks which have been received from His Royal Highness.

The SECRETARY (Mr. T. B. Turner) read the following communication from His Royal Highness:—

"My Lords, Ladies and Gentlemen,

"I am very sorry that I am unable to take the Chair at your Annual Meeting to-day. I can assure you this is not through any lack of interest in the work of the Society, but on account of other engagements that have made it impossible for me to keep the date free.

"It has been a real pleasure and interest to me to have taken part in the work and deliberations of the Council at such meetings as I have been able to attend.

"The outstanding event of my year was, of course, the wonderful Show held at Newcastle-upon-Tyne. I was glad to be able to spend two days at this Show, and I gained much useful knowledge and information from the various sections I inspected and from the exhibitors with whom I came in contact. I am pleased to know that the financial result is satisfactory to you all, and, under the circumstances, I think we can congratulate ourselves. As you know, Newcastle and Tyneside are among the most depressed areas in England, and much has had to be done by Social Service and other bodies to help to relieve the prevailing distress in those districts.

"You have already received a copy of the Report of the work done by the Council on behalf of the Society during the year, and you will hear from Sir Merrik Burrell, whom you are shortly to elect as your President for 1936, what advance is planned during his year of office in all the varied activities of the Society.

"Naturally, I shall continue my interest in the Society upon my retirement from the Presidential Chair, and I should like to take this opportunity of wishing the very best of luck to all concerned in its management."—(Applause.)

Thanks to Retiring President.

The CHAIRMAN: My Lords, Ladies and Gentlemen, I think it is our duty to express our appreciation of the services of His Royal Highness The Duke of Kent during the year, and I would ask you to allow me to move from the Chair a very hearty and sincere vote of thanks to His Royal Highness for his services as President during 1935, for his attendance at our Council meetings, and particularly for his attendance at the Show at Newcastle in July. I am sure this resolution will receive your support.

The resolution was carried with acclamation.

Meeting Room.

The CHAIRMAN: It is now my very pleasant duty to move that the thanks of the meeting be conveyed to the Royal Agricultural Hall Company, Mr.

Alex. Parker, the Managing Director, and the Smithfield Club for placing this room at our disposal this afternoon. I am sure we are most grateful to all those concerned for allowing us to hold our Annual Meeting here, and I hope that you will unanimously pass this resolution, expressing our deep appreciation of the courtesy and kindness shown to us in placing this room at our disposal this afternoon. (Applause.)

VISCOUNT BLEDISLOE, G.C.M.G., K.B.E. : I have much pleasure in seconding the motion.

The motion was carried unanimously.

Report of the Council.

The CHAIRMAN : It is not my intention, as I am sure you will all be relieved to hear, to make a speech this afternoon. I hope that you have read the Report of the Council, which contains a very full review of our activities during the past year, and that you will find that Report and the Statement of Accounts satisfactory. We have had a good year, and I think we are in a position certainly to be optimists to-day. I hope that things are on the up grade now, but, at any rate, so far as the Royal Agricultural Society is concerned, we can look back upon a year of good and steady progress, and I think the future holds out every prospect of being equally good as far as we are concerned. ("Hear, hear.")

I hope you will allow me to take the Report and the Balance Sheet as read.

We are highly honoured by the fact that the Minister of Agriculture, in the midst of his various duties in the House of Commons and in his office, is able to be here this afternoon. ("Hear, hear," and Applause.) I have great pleasure in asking him if he will be good enough to move the adoption of the Report. (Applause.)

The RT. HON. WALTER ELLIOT, M.P. : My Lord Duke, My Lords, Ladies and Gentlemen, I am sure that you will be relieved to hear that, following the admirable example of our Chairman, I do not propose to make a speech to you this afternoon. After all, the general election has not long been over, when I made a number of speeches (some of them to less appreciative audiences than this), and in any case, when there is a fine Fat Stock Show to see and some of you have come up from the country and want to see other things as well in the great city of London, why should you spend your time listening to speeches?

I have much pleasure in moving the adoption of the Report, for the Report does indicate, as the Chairman has just said, a year of useful work.

It is a pity, I think, that the membership is not as high as it might be, and I hope that an increase in the membership will shortly take place, because, after all, these self-governing bodies are the glory of our country. ("Hear, hear.") These non-official self-governing bodies have done a great deal to improve agriculture, not by the efforts of Departments but by the efforts of the folk themselves, and I do hope very much that the greater interest which is being taken by Governments and Departments in agriculture will not result in less interest being taken in agricultural societies by members of the agricultural industry, for, after all, it is the people who do the work who can improve farming, and only they.

We have some friends back from abroad whom we are very glad to see amongst us, such as Lord Bledisloe. (Applause.) There is great point in what Lord Bledisloe says as to the sunny and beautiful country in which he spent five years as the representative of His Majesty the King, but we are all glad to see him back here again.

We have to mourn the loss of one or two friends, such as Lord Cornwallis, who was a very great man in agriculture and to whom we in the Ministry of Agriculture were specially indebted, notably for his services in connection

with the Tithe Commission, which has devoted so much time and attention to that very difficult and thorny problem.

In the Agricultural Hall this week we have one of the best Fat Stock Shows that there have ever been, and there is a number of new things to see in it. There is the Ministry's exhibit, which I have heard criticised and seen criticised, but we make no apologies for our exhibit. ("Hear, hear.") You have got to show not merely what people ought to do but what people ought not to do. Some day I will have a Show consisting of nothing but bad beasts, just to show people what they ought to keep away from. In the old days you showed the best beast, to show what people should live up to. Now you have got to show other things, to show what people ought to keep away from. When one sees the Grade 2 and Grade 3 animals and reflects on what a great percentage of animals, even those coming up for the National Mark, are still classified under Grade 2 and Grade 3, one realises how much quality still counts in agriculture and how large a field there still is for improvement in quality, if we can get caught up to the grand and ideal standards of the King's Prize and the best beast in the Fat Stock Show, or even up to the ordinary standards of a Grade 1 or a Super-Grade animal.

I promised that I would not make a speech, so I do not intend to detain you longer. I have much pleasure in moving the adoption of the Report, and may I say what great pleasure it gives me to be here especially to-day, when you are about to elect my old friend Sir Merrik Burrell to be President of the Society?

Alderman HENRY MATTHEWS (Bristol): My Lord Duke, My Lords, Ladies and Gentlemen, first of all I should like to thank the Society for giving £250 to the Royal Agricultural Benevolent Institution.

Now, I come from Bristol, and I am pleased to see present our friend Lord Bledisloe. As you know, the Show next year is to be held at Bristol, and I can assure you that you will all receive a most hearty welcome. Many improvements have been made in that city since the last Show held there, in 1913, which was a great success. We have a wonderfully good showyard, and we have, now, a new railway station, which will be a great help. Above all, we have one of the finest bridges in the British Empire, the Clifton Suspension Bridge, and, through the efforts of the Honorary Director, the Secretary and the Local Committee, so that there will be no congestion on it, arrangements are being made for the bridge to be freed of toll during the Show week. You will find Bristol a good place in every way for the Show. I have the honour of being a Member of the Local Committee and whatever the Council asks us to do we shall do our best to carry out.

I have great pleasure in seconding the motion for the adoption of the Report.

The CHAIRMAN: If any governor or member would like to make any suggestions or ask any questions arising out of the Report, I should be very glad if he would take this opportunity to do so.

Mr. SPENCER EVANS: I am sure it does not need any words from me to say that our membership should be kept up. For some years, as you are aware, we had a very large membership. I think this matter must be tackled and it is no use delaying our efforts to deal with it, and I have an idea, which I should like to put forward at some time or other, which I am convinced would keep our membership up. In order to get my scheme going, I should very much like to propose that you appoint a small Committee, consisting of five or six gentlemen, to look into this matter; I would then put my idea before them, and they could report to the Council on the whole question. I am confident that, if you care to accept my recommendation on this point, the membership of the Society will be kept up. In the past I have secured a good many members myself; if you had all got as many members for the Society as I have got in the last few years there would not be such a large falling off in our membership.

The CHAIRMAN: I am afraid I cannot give you any definite answer at the moment, but your suggestion will be fully considered at the next meeting of the Council.

Viscount BLEDISLOE: May I refer for a moment to a subject which is very near my own heart and which I am sure is one in which the Minister of Agriculture is equally concerned? I was very glad to hear Mr. Elliot refer to the importance of maintaining the standard of quality of our farm products and particularly of our farm stock. Coming from Gloucestershire, I should like to say what enormous pleasure it gives us in the West of England that our friend Mr. Cridlan has not only obtained the championship this year with an extremely fine Aberdeen-Angus heifer but has done it no less than nine times, thereby creating a record. ("Hear, hear," and Applause.) If I may be allowed to say so, on behalf of the Council of the Society, I am sure we all desire to congratulate Mr. Cridlan not only on his success but—and this is the main purport of my observations—on the way in which he has consistently pointed out to British farmers the type of stock for which there is now the greatest demand by the public. What I want particularly to emphasise in this connection is the importance of drawing the attention of our overseas Dominions, especially Australia and New Zealand, to the eminent desirability of lifting the embargo upon British pedigree stock which New Zealand has continuously imposed for many years past and which Australia has spasmodically imposed at times when it has been reported that there has been an outbreak of foot-and-mouth disease in this country. I have spoken in New Zealand, without any qualification, on the important subject of lifting this embargo, and I want to tell this meeting that, before I ceased to be Governor-General, I had an emphatic, definite and unqualified promise from the two leaders of the Coalition Government that in the early future the embargo in question would be lifted. It has not yet been lifted. A general election was then imminent, and no one knows better than the Minister of Agriculture how cautious one has to be at these general elections. A new Government has come into office, a Labour Government, and I have every reason to believe that that Government will be at least as sympathetic to the claims of British agriculturists as was the late Government of New Zealand, and possibly it will be more sympathetic.

What I do want to emphasise—and I hope the Press will emphasise it—is that there is not the smallest danger of carrying foot-and-mouth disease in a live animal from Great Britain to the Antipodes. Bearing in mind the fact that it takes five to six weeks to carry an animal to that distant part of the Empire and that the period of incubation of the disease is at most something like fourteen days, it is clear that there is not the smallest risk, and there should be no element of fear in the minds of our overseas cousins in once more opening their doors to the pedigree stock of Great Britain. Not only is that stock of every description the finest in the world, but Australia and New Zealand cannot possibly, in face of world competition, continue very much longer without the introduction of this fresh British blood.

With those observations, I desire to support the motion for the adoption of the Report. ("Hear, hear," and Applause.)

The CHAIRMAN: If there are no further remarks to be made, I will now put to the meeting that the Report and Statement of Accounts be approved and adopted.

The resolution was carried unanimously.

Election of President.

THE CHAIRMAN: We have now to proceed to the election of the President, and I have very great pleasure in asking Sir Arthur Hazlerigg to move a resolution in respect to this matter.

Sir ARTHUR HAZLERIGG, Bart.: My Lord Duke, My Lords, Ladies and Gentlemen, it is a very real and a very great pleasure to me to be allowed

to move that Sir Merrik Burrell, Bt., C.B.E., be elected President of the Society to hold office until the next ensuing Annual General Meeting.

It is about 43 years ago that I first had the pleasure of seeing Sir Merrik Burrell. In those days he was perhaps what schoolboys would have called a bit weedy, but he gave evidence then of that beautiful and slim figure which is the envy of some of his friends to-day. (Laughter.) I hasten to add that, comparatively speaking, I was much the same shape, if you can call it a shape, as I am to-day. (Laughter.)

I am not going to take you over the history of those 43 years, but I will say one or two things about it. I am not going to omit anything for fear of bringing a blush to Sir Merrik's cheek (though owing to his great modesty I will spare him), because I say in all truthfulness that, during the whole of the time that I have had his acquaintanceship and his friendship, while I have known him do many kind acts and many gracious acts I have never known him do one act of which he need be ashamed.

Sir Merrik joined the Council of the Royal Agricultural Society in 1921 and became a Vice-President in 1929. He has served on nearly all the Committees; he is Chairman of the Veterinary Committee and Vice-Chairman of the Research Committee. He was chiefly responsible for the creation of the scheme for a Quarantine Station, whereby cattle from this country could be isolated before export to our Dominions, as a protection against infection from foot-and-mouth disease. He secured the premises for the London Quarantine Station and did all the preliminary work of organisation there, and did it extremely well. He was Chairman of the Committee from its commencement in 1927 until the station was taken over by the Ministry of Agriculture and Fisheries some two years ago. In that connection and in connection with what Lord Bledisloe has just said, I hope that every one of you here read the excellent letter which appeared in "The Times" of Monday last by Mr. Alec Hobson on the question of New Zealand refusing our livestock which have passed through the Quarantine Station. I am glad to hear from the late Governor-General that now, after five years of his eloquence, New Zealand is coming to a better frame of mind, and I congratulate him on that. I only wonder they held out so long! (Laughter.)

Sir Merrik Burrell is Chairman of the Agricultural Committee of the County Councils' Association and also Chairman of the Governors of the Royal Veterinary College, where he is doing magnificent work; he is, too, Chairman of the Animal Diseases Committee of the Agricultural Research Council. He often acts as a Judge at our Shows. If there is one fault one can find in him it is that he is perhaps almost too conscientious. It is always a miracle to me how he gets through all the work he does and how he remembers the details of all the various bodies with which he is connected, but he does work very hard for the Royal Agricultural Society and for many other agricultural bodies. He works honestly and well in every one of them, and it is because of that great work and because I know from my personal knowledge that he will make a very good President that I have the greatest pleasure in proposing that he be elected President for the ensuing year.

The Chairman: I have great pleasure in asking Sir Archibald Weigall to second the motion.

Lieut.-Col. Sir Archibald G. Weigall, K.C.M.G.: My Lord Duke, My Lords, Ladies and Gentlemen, I am only too delighted to have the opportunity of seconding this resolution.

When Sir Arthur Hazlerigg at the beginning of his speech referred to Sir Merrik's magnificent proportions, I could not help thinking how appropriate it was that he, who is such a true mirror of the rich pastures of Leicestershire, should move this resolution, and that I, from the poor wolds of Lincolnshire, should second it. (Laughter.)

I have known Sir Merrik for many years now, and it has been my privilege, both at the Royal Agricultural Society and at the Royal Veterinary College, to be able to appreciate his worth. I am not going over all the ground that Sir Arthur has so adequately covered, but I should like to say this, that not only has Sir Merrik done good work on our Committees but also, in reporting the activities of the Committees to the Council, no Chairman has ever been so meticulous to ensure that members of the Council should understand exactly what has happened in Committee.

So far as the Royal Veterinary College is concerned, where I have had the privilege for some years now of intimate association with Sir Merrik, I do not hesitate to say this, that, had it not been for his energy and enthusiasm, the new building that is now in course of erection could never have been even started. The whole of the veterinary profession are under an enormously deep debt of gratitude to Sir Merrik for what he has done at the College, as indeed is every stock breeder in this country, in connection with the health of stock.

But it is really for a very much wider reason that I am only too delighted to second this resolution to-day. All of us who have passed the 60 age mark sometimes realise, I think, with regret, that the relentless march of democracy, however much good it has done (and I admit that it has done enormous good) has left scars on our rural life which will never be eradicated. Traditions have been lost and ties have been loosened, and, when we think of the days before the scents of country life were destroyed by petrol fumes and before the sounds of country life were deadened or dulled by the rattle of machinery, we are happy to remember that we did live in a different age.

Sir Merrik, by his ability and by his energy and enthusiasm, could have had what are popularly known as the glittering prizes of public life, but he has not. He has done really a much bigger work, because in his own county he has kept alive all that makes for real good in the rural life of this country, which, after all, no other country in the world has got or has ever had. It is for that reason that he is the embodiment of our motto, "Practice with Science." He has given his life to all that makes for good in the real rural life of this country, and I am, as I have said, only too delighted to have the opportunity of seconding this resolution. In doing so, let me say this, that I am as earnest in the prayer that he may have a really successful year of office as I am confident in the hope that it will be of enormous advantage to our Society and a credit to himself.

I beg to second.

Lord ELTISLEY, K.B.E.: My Lord Duke, My Lords, Ladies and Gentlemen, as one who does not come from the fat pastures of Leicestershire or from the thin wolds of Lincolnshire but is just an ordinary representative of the eastern counties, I should like most heartily to support this resolution.

Sir Merrik Burrell is doing and, I am sure, will continue to do the finest possible work for the advancement of the Royal Agricultural Society's interests and for agriculture as a whole in this country, and, in so far as we are able in this Society to do good work (I feel that we are far too tightly bound within the four corners of our Charter for modern agricultural conditions), I know that Sir Merrik, with his close connection, to which reference has been made, with outside organisations and other interests, will be just the man to advance the welfare of this Society and the cause for which it stands. I support his nomination with much enthusiasm, because he has been well tried in the hard school of experience, and his knowledge, ability and courage are just what we require for the leadership of an organisation like this, backed as it is by its 9,000 members distributed throughout the country.

Even here in England, industrialised as we are, agriculture still remains the great pillar which must always maintain the economic development of our country, and I venture to think that agriculture is going to play a larger

part in the future. Therefore the question of leadership in agriculture is more important that ever it was. I am glad to think that, through the powerful constructive efforts of the great National Farmers' Union, through the work of the Marketing Boards, which have such a tremendous task to deal with, through the powerful House of Commons Agricultural Committee, and, above all, through the good will of the people of this country, agriculture is daily becoming more powerful and more articulate. Those who know Sir Merrik Burrell know that he does not fail to be articulate. I am not going further into that point, but I should like to say that I am sure Sir Merrik will do all he can to collaborate with all the other organisations and to present our cause, the cause of agriculture, first and all the time, with sympathy, persistency and courage. He is, in my opinion, just the type of thoroughbred Englishman that we want to control the destinies of our Society.

I beg to support the nomination.

The CHAIRMAN : I have the greatest confidence in putting to the meeting that Sir Merrik Burrell be elected President of the Society to hold office until the next ensuing Annual General Meeting.

The resolution was carried with acclamation.

Sir MERRIK R. BURRELL, Bt., C.B.E. : My Lord Duke, My Lords, Ladies and Gentlemen, last summer, when the late Lord Cornwallis suggested to the Council that my name should go forward for election as your President, I was a very proud man. I was very proud to feel that a man of such sound judgment as the late Lord Cornwallis should have thought me worthy. I should like, as I have mentioned his name, to say that no one deplores more than I do his loss—his loss to the Society, his loss to the county of Kent and his loss to England. Since the day when I heard that my name had been put forward I have been living in a kind of dream, afraid of waking up and finding that it was not true. To-day, by your kindness, you have made that dream turn into a great reality for me, for one who lives, as I have lived now for some years, entirely in the interests of agriculture cannot aspire to a greater honour than you have kindly conferred upon me this afternoon. I should like to say at once that I realise to the full that I owe this distinction to the kindness of the Council to me through many years. They have entrusted me with various pieces of work from time to time and have then supported me by their advice, their encouragement and their help. Surely it is a great kindness not only to give a man opportunities but to help him to seize them and then help him to make good. Such kindness as that cannot be acknowledged very easily in words.

Sir Arthur Hazlerigg, Sir Archibald Weigall, you and I have worked together, as you have said, for many years in many ways, and during those years I have come to have a very sincere and a very real affection for both of you. To-day you have been overkind to me. It is usual on such occasions as this to leave out all that is not very good in a man's character and to think only of the good traits in it and then exaggerate them. You both know me very well, and so you both know a good many things which you have left out. Therefore, for the fact that you have not told the whole truth and nothing but the truth, I am very grateful to you. (Laughter.)

I looked back the other day to see how long my family had been connected with the Royal Agricultural Society, and I found that in 1839, when this great Society was founded, my great-grandfather, Sir Charles Burrell, was on the original Management Committee, as the Council was then called. ("Hear, hear.") He was rather a great old man in his way, down in our part of the world, and, incidentally, he was the father of the House of Commons, being a Member for 56 years. My grandfather and my father were members of the Society, and you have to-day by your kindness tightened the knot which has bound my family with this Society now for nearly a hundred years. ("Hear, hear.") I am glad and proud—justifiably proud, I think

—to know that that connection is going to continue in the next generation, and I hope it will do so in the generations that follow. My eldest son has been a member of the Council for two or three years now, and to-day he was selected to follow in Mr. Harris's footsteps as Steward of the Cattle section of our Show. ("Hear, hear.") If he can do half as well in future years as Mr. Harris has done for many years past, he will do very well. ("Hear, hear.") Mr. Harris was one of those quiet workers who get through a tremendous amount of work very efficiently, without making any fuss about it, and I should think that only Lord Daresbury and Mr. Burke, as Honorary Directors, have any conception of what this Society owes to Mr. Harris for the work he has done in past years. ("Hear, hear.") I may say in passing that it was only the fact that Mr. Turner pointed out to me that there was a clause in our original Charter preventing anyone under the age of 21 being elected a life member of this Society that stopped me applying for both my grandsons to be made life members.

May I now turn for a moment to a few matters on which I feel sure our President would have touched if he had been here to-day?

First, I am afraid I must refer again to the serious decrease in the number of members of this Society. Ten years ago we had over 13,000 members, and the number has fallen now to 9,000. I think there is no doubt at all that the Royal Agricultural Society of England ought to have at least 20,000 members. I know that the decrease in membership has been caused by the agricultural depression through which we have been passing, but the tide, as you, my Lord Duke, have said, is now turning, and we should take advantage of the turn of the tide and try not only to get back to where we were but to get to where we ought to be. I am of opinion that it is only through the personal efforts of the ordinary members of this Society that we shall do that. The members of the Council, who already give a great deal of time and thought to the work of the Society, will, of course, be only too glad to help you, but, in return for what they do, they ask you for your support in this matter. I do earnestly ask all the members of the Society who are here to-day and all those who are not here to give me their assistance during my year of office in trying not only to get the membership back to 13,000 but to get it up to the 20,000 that it ought to be. It will need a very big effort to accomplish that aim.

With regard to the Newcastle Show, it was, like all the five previous Shows we have had there, a great success. We had a good Show, fine weather and a good gate. If, in the stress of work at the time of the Show, any of those who gave us such great and practical help were not personally thanked at the time, I should like now to offer them the sincere thanks of the Society for all they did to assist us and to assure them that it will be many years before we forget their kindness and their help.

Next year the Show will be held at Bristol, where we have always received a cordial welcome and where, as Mr. Matthews has told us to-day, preparations are already being made to welcome us again. The ground, which has been kindly lent to us by the Hon. Mrs. Esmé Smyth, is well on in preparation. You will see at Bristol one of the most comprehensive Shows that this Society has ever staged. We have got classes not only for every one of the more important breeds of stock in the country but also for some of the more local breeds, such as Gloucestershire cattle, Exmoor Horn sheep, Dartmoor ponies, and other breeds which are not very often seen at our Show. I should like to say how much the Society is once again indebted to the Breed Societies for all they do to help us, for the great help that they always give us year by year and the practical assistance they give to their own members by putting up large sums of money to swell our Prize Fund. You will, I know, be delighted to hear that our Chairman was able to announce at the meeting of the Council which was held this morning that the Duke of York, accompanied, we sincerely hope, by the Duchess, will be present at the show at Bristol.

("Hear, hear.") I am sure you will recognise that as being one more sign of the keen and continued interest that His Majesty the King and every member of his family takes in the Society.

There will be put up at the Show next year an especially fine exhibit on the educational and research side. It is being organised by a special Committee formed of agricultural experts and advisers under the chairmanship of Sir William Dampier.

But the Show, great as it is, great and important as its educative and trade advantages are, does not appeal to everybody equally, and I would therefore ask you not to overlook all the other work that the Royal Agricultural Society does on your behalf. As Chairman of the Veterinary Committee, as your understudy, my Lord Duke, on the Research Committee, and as a member of the Education Committee, I can assure you, Ladies and Gentlemen, that the work of those Committees is carried out in no perfunctory manner. The members of those Committees give a great deal of time and thought to their work, and some of those members are men of world-wide reputation. I have not added it up carefully, but it may astonish you when I tell you that I believe that on research work, educational work and advisory services the Royal Agricultural Society spends nearly £4,000 a year. Then there is also the work of the Chemical Committee, the Dairy Committee, and the Botanical and Zoological Committee. You must remember that it is only quite recently that you have been able to obtain advice on those subjects anywhere except from the advisory officials retained by this Society, men who have spent their lives in studying the subjects.

I think I have said enough to prove to you, who are already members, the advantages that you possess, and to give you some ammunition to use in trying to bring in others who are not at present members of the Society, and thus helping the Society to have the strength that it should have.

The Society must, as has been pointed out here this afternoon, take part in the agricultural policy of the future. It cannot stand aside. It is not a political body in any way, but, in the case of purely agricultural matters, it is right that it should on occasion speak. Therefore I ask you to nourish its body with an inflow of members and to see that those you put at its head, the members of the Council, are men of knowledge and vision. You must remember that agriculture has at long last been recognised, both by the public and by the Government, as an essential element in the economic welfare of the whole country. In the efforts made to save agriculture there have been what one might almost call revolutionary changes in the last three or four years. Any revolution is a gamble, and never more so than when applied to an industry such as agriculture, which is composed of slowly maturing processes. Some of you may say perhaps that the Royal Agricultural Society should never enter into the arena of policy at all. I do not agree with that. You may say that all such matters should be left to the National Farmers' Union. I do not agree with that. I think that these great problems should be looked at from every possible aspect. You must remember that in Bedford Square, whereas the offices of the National Farmers' Union look north, ours look south. A north light, as we all know, is the best for an artist working in a studio who wishes to see his own work in the best possible light. It is also the best light for a man working in a laboratory, who needs to shut one eye to look through a microscope at infinitely small things and see them out of all proportion to the world. But I think that, great as is the work which is done in studios and in laboratories and marvellous as are the results that have been thus achieved, yet, when you want to look at things as they really are, in their true colours and not magnified, it is wiser to stand at an open window with both your eyes wide open, in a house that faces south.

My Lord Duke, My Lords, Ladies and Gentlemen, I have so far said nothing in the way of thanks for the great honour you have conferred upon me.

Except to say " Thank you " very sincerely, very gratefully and very humbly, I do not intend to do so. A long and eloquent speech would not express what I am feeling in my heart at the moment, and so any halting phrases of mine would only sound absurd. I feel that it is only by my deeds through a whole year of office that I can hope to prove how grateful I am to you and how devoted I am to this Society, and that, My Lords, Ladies and Gentlemen, I intend to try to do.

Election of Trustees.

The CHAIRMAN : We will now proceed to the election of the Trustees. It is customary for them to be elected by a show of hands. The names of the present Trustees, who are, under Bye-law 141, recommended by the Council for re-election, are printed in List " A " on the agenda paper, and I will now ask you to signify in the usual manner whether it is your pleasure that these twelve noblemen and gentlemen should be elected Trustees of the Society to hold office until the next ensuing Annual General Meeting.

A show of hands was taken, and the Trustees were unanimously re-elected as follows :—

H.R.H. The Prince of Wales, K.G., York House, S.W.1.
H.R.H. The Duke of York, K.G., 145, Piccadilly, W.1.
H.R.H. The Duke of Gloucester, K.G., Buckingham Palace, S.W.1.
H.R.H. The Duke of Kent, K.G., 3, Belgrave Square, S.W.1.
Charles Adeane, C.B., Babraham Hall, Cambridge.
Duke of Bedford, K.G., Woburn Abbey, Bedfordshire.
Percy Crutchley, Sunninghill Lodge, Ascot, Berkshire.
Lord Daresbury, C.V.O., Walton Hall, Warrington.
Duke of Devonshire, K.G., Chatsworth, Bakewell, Derbyshire.
Lord Harlech, C.B., Brogyntyn, Oswestry, Shropshire.
Sir Arthur Hazlerigg, Bart., Noseley Hall, Leicestershire.
Lt.-Col. E. W. Stanyforth, C.B., Kirk Hammerton Hall, York.

Election of Vice-Presidents.

The CHAIRMAN : We now pass to the election of Vice-Presidents. I will ask you to signify by show of hands whether it is your pleasure that the present Vice-Presidents, whose names are printed in List " B," should be re-elected to hold office until the next ensuing Annual General Meeting.

A show of hands was taken, and the Vice-Presidents were unanimously re-elected as under :—

U. Roland Burke, Edensor House, Bakewell, Derbyshire.
Sir Merrik R. Burrell, Bt., C.B.E., Floodgates, West Grinstead.
Earl of Derby, K.G., Knowsley, Prescot, Lancashire.
Lord Desborough, K.G., Taplow Court, Maidenhead.
R. M. Greaves, Wern, Portmadoc, North Wales.
Earl of Harewood, K.G., Harewood House, Leeds.
William Harrison, Albion Iron Works, Leigh, Lancashire.
Lord Mildmay of Flete, Flete, Ermington S.O., Devon.
Duke of Portland, K.G., Welbeck Abbey, Worksop, Notts.
Earl of Powis, Powis Castle, Welshpool, Mont.
Earl of Stradbroke, K.C.M.G., Henham Hall, Wangford, Beccles.
Earl of Yarborough, K.G., Brocklesby Park, Habrough, Lincs.

Election of Professional Accountants and Auditors.

The CHAIRMAN : We have now to proceed to the election of Auditors, and I will ask Mr. L. K. Osmond to move a resolution.

Mr. L. K. OSMOND : I have much pleasure in moving that Messrs. Price, Waterhouse & Co. be re-elected as professional accountants and auditors to the Society for the ensuing year.

I come from the wolds of Lincolnshire, where you will find some of the best cattle breeders, the best horse breeders, the best sheep breeders and the best pig raisers in the country. Many people who travel through Lincolnshire express astonishment at the way in which the tenant farmers there have farmed the land during these recent disastrous years. They cannot be beaten by the farmers in any other county in England.

I think we are all agreed that Messrs. Price, Waterhouse & Company have carried out their work for the Society as accurately, carefully and efficiently as anyone could desire, and I have very much pleasure in moving their re-election.

Mr. F. L. Gooch : My Lord Duke, I have very great pleasure in seconding the motion.

I hope that the ordinary members of the Royal Agricultural Society will back up the Council and also the Local Committee, and make the Show at Bristol even better than it was in 1913, when we had an attendance of nearly 180,000 and a balance on the right side of over £3,000. ("Hear, hear.")

The resolution was put to the meeting by the Chairman and carried unanimously.

Elections to the Council.

The Chairman : We now proceed to the election of the Council. Under the Bye-laws, the requisite measures have been taken to fill the vacancies on the Council in the representation of the Districts in Group "A."

As Chairman, I have now formally to report to the Annual General Meeting the names and addresses of the Ordinary Members of the Council who have been elected by the several Divisions in order that the meeting may, in the words of the Bye-law, "take cognisance of their election."

This duty I formally fulfil by placing before you List "C," on pages 3 and 4 of the printed agenda paper, in which the names of the newly elected members are specially marked.

Bedfordshire : Frank Webb, Billington Estate Office, Leighton Buzzard.

Cheshire : J. Herbert Hall, Hill House, Mobberley, Knutsford, and R. B. Neilson, Holmwood, Sandiway, Northwich.

Cornwall : Capt. G. H. Johnstone, Trewithen, Grampound Road.

Dorset : Col. Lord Digby, D.S.O., M.C., Minterne, Dorchester.

Hampshire : Major F. H. T. Jervoise, Herriard Park, Basingstoke, and Capt. J. B. Scott, Rotherfield Park, Alton.

Hertfordshire : E. E. Barclay, Brent Pelham Hall, Buntingford.

Lancashire : Windham E. Hale, Mowbreck Hall, Kirkham.

Middlesex : Earl of Strafford, Wrotham Park, Barnet.

Monmouthshire : L. Foster Stedman, Machen House, Lower Machen, near Newport.

Norfolk : Capt. H. G. Buxton, Cokesford Farm, Tittleshall, King's Lynn, and Lord Hastings, Melton Constable Park.

Northants : F. H. Thornton, Kingsthorpe Hall, Northampton.

Northumberland : William Robertson, Stamford, Alnwick, and C. H. Sample, 26, St. Mary's Place, Newcastle-on-Tyne.

Staffordshire : Major R. A. Dyott, The Manor of Freeford, Lichfield.

Worcestershire : John Walker, Knightwick Manor, Worcester.

Yorks. (N. Riding) : Major Gordon B. Foster, Leysthorpe, Oswaldkirk, York.

Scotland : Earl of Elgin, K.T., Broomhall, Dunfermline, and James Kilpatrick Craigie Mains, Kilmarnock.

This list is, however, now incomplete, as vacancies have been created in Durham by the death of Mr. Burkitt, and in Derbyshire by the election of Mr. Burke as a Vice-President to fill the vacancy caused by the death of the Rev. C. H. Brocklebank. Otherwise the members will be aware that all the necessarily formalities have been taken to fill up the vacancies on the Council.

Questions Invited.

Although I have given members and governors an opportunity of asking any questions, if before the end of the meeting any member or governor would like to raise any further point or to ask any further question I should be very glad if he would take this opportunity of so doing.

(No Member rose to take advantage of this invitation.)

Chairman Thanked.

Lieut.-Col. E. W. STANYFORTH, C.B. : My Lord Duke, I crave your indulgence and that of the meeting generally for two or three minutes. I am sure that the meeting will give me this indulgence, because I am perfectly certain that none of you, Ladies and Gentlemen, would like the Duke of Devonshire to leave this room without our according him a very hearty vote of thanks for taking the chair at this meeting. ("Hear, hear," and Applause.) The Duke of Devonshire is no ordinary figurehead as a member of the Council and as a Trustee of this great Society. Ever since his election to the Council he has always been a real worker and helper to all of us on the Council. ("Hear, hear.") He is always willing to serve on any of the Committees, and he has been Chairman of perhaps one of the most important Committees of our Council.

It was only yesterday, when we learned that the Duke of Kent would be unable to attend to-day either our Council meeting in Bedford Square or our Annual Meeting here, that I ventured to suggest to the Committee that dealt with the matter that the Duke of Devonshire might take the Chair on both occasions. When he was asked to do so, he at once said, as he has said many times : "I will do anything that I can to help." That has been the maxim, I think, of the Duke of Devonshire ever since he became a member of the Council of the Royal Agricultural Society. ("Hear, hear," and Applause.) Whenever he has been called upon to take the Chair at a moment's notice or to become a member of a special Committee or to do anything else for the Society, the noble Duke has always said : "I shall be only too glad to do it."

I know that you would all wish to show how deeply you appreciate the kindness of the Duke of Devonshire in taking the Chair, at practically a moment's notice, both this morning in Bedford Square and here this afternoon, and I therefore ask you to accord him a very hearty vote of thanks. ("Hear, hear," and Applause.)

Mr. C. ADEANE, C.B. : My Lords, Ladies and Gentlemen, the Royal Agricultural Society has no greater friend than the Duke of Devonshire, and I have very much pleasure in seconding this resolution.

The motion was put to the meeting by Colonel STANYFORTH and carried with acclamation.

The CHAIRMAN : I thank you very sincerely for the kind vote of thanks you have passed, although I feel that I have done nothing to deserve it. When I was asked to take the Chair to-day, I said that I could neither hear nor see very much, but that I should be very glad to do my best. That reminds me that when I was coming away from another institution a few days ago I heard someone standing outside make the observation : "This appears to be a place for the lame and the blind." (Laughter.)

I deeply regretted, as I am sure you all did, that His Royal Highness was unable to be with us this afternoon, and I hope that I have not proved a very inadequate substitute for His Royal Highness. (Applause.)

I can assure you that if on any occasion I can do any work for this Society, with which I have now been closely identified for a considerable number of years, I shall be only too pleased to do so.

I have not written and I do not propose to write my reminiscences, as so many people do nowadays—(Laughter)—but I can assure you that, if I did do so, my connection with the Royal Agricultural Society of England would occupy a very high and a very honoured place. (Applause.)

Royal Agricultural Society of England.

AWARDS OF PRIZES

AT

NEWCASTLE, 1935.

ABBREVIATIONS.

I., First Prize. II., Second Prize. III., Third Prize. IV., Fourth Prize. V., Fifth Prize. VI., Sixth Prize. R.N., Reserve Number. H.C., Highly Commended. C., Commended.

The responsibility for the accuracy of the description or pedigree and for the eligibility to compete of the animals entered in the following classes, rests solely with the Exhibitors.

Unless otherwise stated, each Prize Animal in the Classes for Horses, Cattle, Goats, Sheep, and Pigs, was "bred by Exhibitor."

HORSES.

Shires.

Class 1.—*Shire Stallions, born in* 1932.

4 I. £20 & Champion.[1]—REUBEN HAIGH, Peny-Gardden, Ruabon, Wrexham, for Friden Sundridge 41401, bay, bred by Joseph Davidson, Friden Grange, Hartington, Buxton; *s.* Sundridge Nulli Secundus 36952, *d.* 120914 Norwich Ladyship *by* Herontye Buscot 37494.

1 II. £10.—HIS MAJESTY THE KING, Sandringham, for Appleton Binder 41341, brown; *s.* Pendley Harvester 40368, *d.* 121191 Pendley Choice *by* Monks Green Friar 35891.

2 III. £5.—JAMES GOULD, Crouchley Hall, Lymm, for Lymm Grey King 41462, grey, bred by George Roberts, Hazelmere, Creswell, Mansfield; *s.* Carlton Grey Kingmaker 40240, *d.* 119770 Hazelmere Venus *by* Harboro Nulli Secundus 33231.

3 R.N.—SIR BERNARD GREENWELL, BART., Marden Park, Woldingham, for Marden Bandit.

Class 2.—*Shire Stallions, born in* 1933.

12 I. £20 & R.N. for Champion.[1]—THE EXORS. OF THE LATE J. G. MCDOUGALL, Chippinghurst Manor, Cuddesdon, Oxford, for Whittlesea Coming King 41842, bay, bred by Griffin & Smith, Singlecote, Thorney, Peterborough; *s.* Pendley Harvester 40368, *d.* 122755 Ashill Coma *by* Ditchingham John 38164.

9 II. £10.—G. R. C. FOSTER, Anstey Hall, Trumpington, Cambridge, for Bower Draughtsman 41581, bay; *s.* Bower Winalot 40672, *d.* 119635 Eveline *by* Lincoln What's Wanted 2nd 35812.

7 III. £5.—JAMES FORSHAW & SONS, Carlton-on-Trent, Newark, for Carlton Radium 41605, brown, bred by William White, Field House, East Markham, Retford; *s.* Radium 5th 40376, *d.* 122215 Markham Blended Lady *by* Buckwell Blend 39123.

6 R.N.—WILLIAM EDWARD DODD, Cofton Hall, Barnt Green, Birmingham, for Cofton Hall Seedsman.

Class 3.—*Shire Stallions, born in* 1934.

15 I. £20.—JAMES FORSHAW & SONS, Carlton-on-Trent, Newark, for Harcourt Radium, brown, bred by Mrs. Sidney Freckleton, Newton Harcourt, Leicester; *s.* Radium 5th 40376, *d.* 122009 Harcourt Lady *by* Moulton Crusader 39557.

[1] Champion Gold Medal, and £5 to the Reserve, given by the Shire Horse Society for the best Stallion. A Prize of £2 is also given by the Shire Horse Society to the Breeder of the Champion Stallion, provided the Breeder is a Member of the Shire Horse Society. and the dam of the animal is registered in the Shire Horse Stud Book.

17 II. £10.—SIR BERNARD GREENWELL, BART., Marden Park, Woldingham, for **Marden Defender**, bay; *s.* Marden Waggoner 40980, *d.* 123999 Marden Vixen *by* Champion's Goalkeeper 30296.

14 III. £5.—THE DUKE OF DEVONSHIRE, K.G., Chatsworth, Bakewell, for **Chatsworth Monk**, brown, bred by M. Hubbard, Eaton, Grantham; *s.* Ivy Monk 41432, *d.* 124666 Ivy May Flower *by* Leek Wonder 40105.

13 R.N.—THE DUKE OF DEVONSHIRE, K.G., for **Chatsworth Abbot**.

Class 4.—*Shire Mares, with their own foals at foot.*

20 I. £20 & Champion.[1]—JAMES GOULD, Crouchley Hall, Lymm, for **123153 Lymm Sunset**, bay, born in 1928 [foal *by* Beacon What's Wanted 41089]; *s.* Herontye Buscot 37494, *d.* 119889 Lymm Sunbeam *by* Mosscar Forest Champion 38929.

19 II. £10.—G. R. C. FOSTER, Anstey Hall, Trumpington, Cambridge, for **Bower Joan 2nd**, bay, born in 1931 [foal *by* Bower Winalot 40672]; *s.* Statfold Nulli Secundus 40170, 119376 Bower Joan *by* Withy Pitts Gay Prince 39072.

Class 5.—*Shire Colts or Filly Foals, the produce of Mares entered in Class* 4.[2]

22 I. £10.—JAMES GOULD, Crouchley Hall, Lymm, for **Lymm Sunray**, bay filly, born April 19, 1935; *s.* Beacon What's Wanted 41089, *d.* 123153 Lymm Sunset *by* Herontye Buscot 34794.

21 II. £5.—G. R. C. FOSTER, Anstey Hall, Trumpington, Cambridge, for brown filly, born March 20, 1935; *s.* Bower Winalot 40672, *d.* 125183 Bower Joan 2nd *by* Statfold Nulli Secundus 40170.

Class 6.—*Shire Mares, born in or before* 1931, *not having a foal at foot. A Mare* 6 *years old or over must have produced a live foal in* 1934 *or* 1935.[2]

23 I. £15 & R.N. for Champion.[1]— A. H. CLARK & SON, Moulton Eaugate, Spalding, for **121579 Alsager Peach**, bay, born in 1927 [foal born April 10, 1934, *by* Bower Winalot 40672], bred by T. S. Pidduck, Corbrook Court, Audlem; *s.* Moulton Harboro 39559, *d.* 101014 Alsager Future Queen *by* Champion's Goalkeeper 30296.

26 II. £10.—E. PATCHETT, Grattan Road, Bradford, for **124428 Bradford Girl**, bay, born in 1930; *s.* Bradford Seedsman 40222, *d.* 107462 Cippenham Merry Girl *by* Monks Green Friar 35891.

25 III. £5.—THE EXORS. OF THE LATE J. G. MCDOUGALL, Chippinghurst Manor, Cuddesdon, Oxford, for **Ruth of Chippinghurst**, bay, born in 1931, bred by T. H. B. Freshney, Worlaby, Brigg; *s.* Ratler 5th 40376, *d. by* Carlton Friar Tuck 36384.

24 R.N.—G. R. C. FOSTER, Anstey Hall, Trumpington, Cambridge, for **Pendley Lady May**.

Class 7.—*Shire Fillies, born in* 1932.

28 I. £20.—JAMES GOULD, Crouchley Hall, Lymm, **126214 Lymm Lady Grey**, grey, bred by George Roberts, Hazelmere, Creswell, Mansfield; *s.* Carlton Grey Kingmaker 40240, *d.* 118333 Hazelmere Frieze *by* Harboro Nulli Secundus 33231.

27 II. £10.—A. H. CLARK & SON, Moulton Eaugate, Spalding, for **126265 Moulton Gloria**, black; *s.* Eaton Premier King 39486, *d.* 123223 Moors Charm *by* Moulton Harboro 39559.

Class 8.—*Shire Fillies, born in* 1933.

33 I. £20.—A. THOMAS LOYD, Lockinge House, Wantage, for **126957 Lockinge Harvest Moon**, bay; *s.* Ridgeway Renown 41030, *d.* 114377 Hanbury Harboro Starlight *by* Harboro Nulli Secundus 33231.

30 II. £10.—G. R. C. FOSTER, Anstey Hall, Trumpington, Cambridge, for **126653 Bower June Rose**, bay; *s.* Bower Winalot 40672, *d.* 122955 Donington May Queen *by* Frithville Golconda 39496.

29 III. £5.—A. H. CLARK & SON, Moulton Eaugate, Spalding, for **Moulton Harmony 127037**, bay; *s.* Tarnacre Harboro 40626, *d.* 117002 Moulton Twin *by* Moulton Abbot 35902.

31 R.N.—G. R. C. FOSTER, for **Bower Regina**.

Class 9.—*Shire Fillies, born in* 1934.

38 I. £20.—A. THOMAS LOYD, Lockinge House, Wantage, for **Lockinge Venus**, bay; *s.* Ridgeway Renown 41030, *d.* 114377 Hanbury Harboro Starlight *by* Harboro Nulli Secundus 33231.

36 II. £10.—SIR BERNARD GREENWELL, BART., Marden Park, Woldingham, for **Marden Daisy**, bay; *s.* Marden Waggoner 40980, *d.* 119921 Marden Suzanne *by* Champion's Goalkeeper 30296.

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[1] Champion Gold Medal, and £5 to the Reserve, given by the Shire Horse Society for the best Mare or Filly. A Prize of £2 is also given by the Shire Horse Society to the Breeder of the Champion Mare or Filly, provided the Breeder is a Member of the Shire Horse Society, and the dam of the animal is registered in the Shire Horse Stud Book.

[2] Prizes given by the Shire Horse Society.

Class 10.—*Shire Geldings, by registered sires, born in or before* 1932.[1]

45 I. £20.—CHARLES FRANKLIN, 10, Bank Buildings, Bedford, for **Pendley Warrant**, bay, born in 1928, bred by Bibby Bros., Coat Green Farm, Carnforth; *s.* Lincoln's What's Wanted 2nd 35812, *d.* 111306 Coat Green Encore *by* Rokeby Clansman 36023.
44 II. £15.—GEORGE THOMAS BEAL, Great Kendale, Driffield, for **Kendale Dreadnought**, dark brown, born in 1930, bred by William Haywood, Laneham, Retford; *s.* Boro Monk 40035.
48 III. £10.—MANN, CROSSMAN & PAULIN, LTD., Albion Brewery, Whitechapel Road, London, for **Champion**, bay, born in 1929, bred by J. Downes Evans, Wernllwyd, Berriew, Mont.; *s.* Powisland What's Wanted 39958.
46 IV. £5.—LIVERPOOL CORPORATION, VETERINARY DEPARTMENT, 30, Hatton Garden, Liverpool, for **Hannibal**, brown, born in 1927, bred by R. C. Price, Broughton, Shrewsbury; *s.* Hafren Baronet 39501, *d.* 99075 Maesyrhandy Blackbird *by* Llyssun Nero 30630.
52 V. £5.—YOUNG & CO.'S BREWERY, LTD., Ram Brewery, Wandsworth, London, S.W., for **Midland**, bay, born in 1929, bred by J. Mapletoft, Leadenham, Lincoln; *s.* Midlands Lion 37660.

H.C.—41, 43, 50, 51.

Class 11.—*Teams of Three or Four Shire Horses, mares, geldings or mixed, in harness with vehicle.*

57 I. £10.—MANN, CROSSMAN & PAULIN, LTD. Team of Four Geldings.
58 II. £5.—YOUNG & CO.'S BREWERY, LTD. Team of Three Geldings.
55 III. £3.—C. & M. BARKER, Stilton House, Helmsley. Team of Three Geldings.
56 R.N.—LIVERPOOL CORPORATION. Team of Three Geldings.

Clydesdales.[2]

Class 12.—*Clydesdale Stallions, born in* 1933.

60 I. £20.—JAMES KILPATRICK, Craigie Mains, Kilmarnock, for **Craigie Reformer 2439**, bay, bred by J. E. Kerr, Harviestoun, Dollar; *s.* Craigie Beau Ideal 21856, *d.* Harviestoun Alida 59945 *by* Drumry Reformer 19698.
59 II. £10.—DAVID ADAMS, Auchencraig, Dumbarton, for **His Majesty 22481**, bay; *s.* Woodbank Majestic 21393, *d.* Happy Thought 58353 *by* Dunure Footprint 15203.

Class 13.—*Clydesdale Stallions, born in* 1934.

64 I. £20 & Champion.[3]—JAMES KILPATRICK, Craigie Mains, Kilmarnock, for **Craigie Magnificent**, brown, bred by Robert Dalziel, Rue, Auldgirth; *s.* Craigie Beau Ideal 21856, *d.* Rue May Queen 57974 *by* Balcairn Footnote 20701.
66 II. £10 & R.N. for Champion.[3]—JAMES KILPATRICK, Hawkrigg House, Wigton, for **Hawkrigg Choice**, bay, bred by I. & F. Beaton, Mains of Glack, Pitcaple; *s.* Craigie Beau Ideal 21856, *d.* Glack Margaret 56402 *by* Dunure Footprint 15203.
65 III. £5.—JAMES KILPATRICK, Craigie Mains, for **Craigie Martin**, bay, bred by Martin J. W. Meikle, Clockston, Tarbolton; *s.* Craigie Beau Ideal 21856, *d.* Clockston Daphne 60658 *by* Woodbank Majestic 21393.
63 IV. £3.—JAMES KILPATRICK, Craigie Mains, for **Craigie Favourite**, bay; *s.* Craigie Beau Ideal 21856, *d.* Craigie Felicity 59420 *by* Benefactor 20867.
69 R.N.—JOHN TOWNSON & SONS, Wackerfield Hall, Staindrop, Darlington, for **Wackerfield Castle.**

Class 14.—*Clydesdale Mares, with their own foals at foot.*

70 £20 & Champion.[4]—DAVID ADAMS, Auchen Craig, Dumbarton, for **Powerful Link 58789**, brown, born in 1926 [foal *by* Craigie Beau Ideal 21856], bred by James Durno, Rothiebrisbane, Fyvie; *s.* Benefactor 20867, *d.* Evening Tide 52150 *by* Rising Tide 17454.
76 II. £10.—MISSES J. & M. PARK, Brunstane, Portobello, Midlothian, for **Lindores 59049**, brown, born in 1926 [foal *by* Craigie Beau Ideal 21856], bred by James Martin, Bellevue, Lindores; *s.* St. Albion 21126, *d.* Johnston Violet 55471 *by* Royal Raeburn 18900.
73 III. £5.—EDWARD NICHOL, Clifton, Morpeth, for **Clifton Lady Glen**, dark bay, born in 1930 [foal *by* The Factor 22053], bred by R. & J. Kerr, Abbey, Madderty, Crieff; *s.* Dunduff Exchequer 21480, *d.* Lady Freshfuel 56558 *by* Dunure Freshfuel 17867.
71 IV. £3.—JAMES LITTLE, High House Farm, Bebside, Northumberland, for **Seaville Favourite 59968**, chestnut, born in 1929 [foal *by* The Factor 22053], bred by Mrs. Cass & Son, Seaville, Silloth; *s.* Dockray Designer 19990, *d.* Seaville Nora 57953 *by* Dunure Fashion Flint 18705.

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[1] Prizes given by the Shire Horse Society.
[2] £90 towards these Prizes were given by the Clydesdale Horse Society.
[3] Champion Silver Medal given by the Clydesdale Horse Society for the best Stallion.
[4] Champion Silver Medal given by the Clydesdale Horse Society for the best Mare or Filly.

Class 15.—*Clydesdale Mares, not having a foal at foot, or Fillies, born in or before* 1932. *A Mare* 6 *years old or over must have produced a live foal in* 1934 *or* 1935.

77 I. £20.—DAVID GOLDIE, Barassie Farm, Troon, for **Barassie Winifred** (Vol. 45, p. 56), bay, born in 1932, bred by John Slater, Grange, Kirkcudbright; *s.* Craigie Winalot 21322, *d.* Grange Ada 55601 *by* Signet 16816.

80 II. £10.—DOUGLAS D. MURRAY, The Dene, Seaham Harbour, for **Rose Marie** 59449, black, born in 1928 [filly foal born April 26, 1935, *by* Craigie Beau Ideal 21856], bred by David McDowall, Glenhowe, Glenluce; *s.* Benefactor 20867, *d.* Mary Ellen 56617 *by* Dunure Footprint 15203.

88 II. £5.—JAMES LITTLE, High House Farm, Bebside, Northumberland, for **Affleck Lady Alice**, black, born in 1931, bred by John Milne, Upper Affleck, Dunecht, Aberdeen; *s.* Royal Factor 21675, *d.* Best Lady 54490 *by* Kismet 18417.

81 IV. £3.—T. SEYMOUR & SONS, Hylton Red House Farm, Southwick, Sunderland, for **Lady Hylton**, roan, born in 1932; *s.* Ardyne Monomark 21423, *d.* Voucher Lady 60803 *by* Buchan Voucher.

Class 16.—*Clydesdale Fillies, born in* 1933.

82 I. £20 & R.N. for **Champion.**[1]—ROBERT DALZIEL, Rue, Auldgirth, for **Rue Perfect Lady**, brown; *s.* Craigie Beau Ideal 21856, *d.* Rue May Queen 57974 *by* Balcairn Footnote 20701.

88 II. £10.—HENRY MURDOCH, Balgreen, Hollybush, for **Balgreen Flash Girl**, bay, bred by David Miller, Upper Milton, Wick; *s.* Douglas Castle 21620, *d.* Chosen Girl 60031 *by* Benefactor 20867.

92 III. £5.—ROBERT TAYLOR, Milton Hall, Brampton Junction, Cumberland, for **Lady Inverclyde**, brown; *s.* Benemerito 21837, *d.* Milton June 60188 *by* Benefactor 20867.

93 IV. £3.—JOHN TOWNSON & SONS, Wackerfield Hall, Staindrop, Darlington, for **Wackerfield Dignity**, brown; *s.* Bonnie Elford 21576, *d.* Wackerfield Lady *by* Ardyne Refiner 19606.

91 R.N.—T. SEYMOUR & SONS, Hylton Red House Farm, Southwick, Sunderland, for **Siealands Sunflower.**

Class 17.—*Clydesdale Fillies, born in* 1934.

94 I. £20.—JAMES KILPATRICK, Craigie Mains, Kilmarnock, for **Craigie Jubilee Queen** bay; *s.* Craigie Beau Ideal 21856, *d.* Polly of Kerse 54947 *by* Craigie Excelsior 18664

96 II. £10.—DOUGLAS D. MURRAY, The Dene, Seaham Harbour, for **Seaham Norma**, bay, bred by W. B. McFarlane, Meikle Kilchatton; *s.* Craigie Beau Ideal 21856, *d.* Karine 59451 *by* Benefactor 20867.

95 III. £5.—HENRY MURDOCH, Balgreen, Hollybush, for **Balgreen Fame**, brown, bred by John S. Hunter, Foulton, Monkton; *s.* Douglas Castle 21620, *d.* Foulton Darling *by* Dunduff Volume 21481.

100 IV. £3.—ROBERT TAYLOR, Milton Hall, Brampton Junction, Cumberland, for **Milton Marina**, bay; *s.* Craigwell 21739, *d.* Milton Marigold 60189 *by* Benefactor 20867.

99 R.N.—T. SEYMOUR & SONS, Hylton Red House Farm, Southwick, Sunderland, for **Hylton Queen.**

H.C.—98. C.—97.

Class 18.—*Clydesdale Geldings, by registered sires, born in or before* 1931.

105 I. £20.—CORPORATION OF GLASGOW, CLEANSING DEPT., 20, Trongate, Glasgow, for **Colin**, dark brown, born in 1930, bred by Messrs. Reid, The Blair, Old Meldrum; *s.* Tolquhon Chief 21543.

109 II. £10.—WILLIAM YOUNG, West Preston, Preston Mill, Dumfries, for **Preston Willie**, bay, born in 1931, bred by John S. Prudham, White Field, Heads Nook, Carlisle; *s.* Kelsick Refiner 21648, *d.* Vonnie 55138 *by* Dunure Expression 19103.

106 III. £5.—MESSRS. GREIG, Housenrigg, Brayton, Aspatria, for **Fashion**, black, born in 1930, bred by Mr. Jackson, Stainburn, Workington; *s.* Cumberland Fashion 19982.

103 IV. £3.—CORPORATION OF GLASGOW, CLEANSING DEPT., for **Carrick**, black, born in 1930, bred by W. Kirkland, Meadowbank, Stair, Ayrshire; *s.* Dunduff Volume 21481.

102 R.N.—J. G. FAIRBAIRN, Ramrig, Duns, for **Sergeant Fashion.**

Class 19.—*Clydesdale Geldings, by registered sires, born in* 1932.

112 I. £20.—MESSRS. GREIG, Housenrigg, Brayton, Aspatria, for **Baird**, bay, bred by Mr. Baird, Silloth House, Silloth; *s.* Dunmore Again 21871.

113 II. £10.—WILLIAM YOUNG, West Preston, Preston Mill, Dumfries, for **Preston Jamie**, black, bred by Mr. McCulloch, Highmye, Stoneykirk, Stranraer; *s.* Ashwood 21424, *d. by* Aitkenbrae Footprint 21033.

111 III. £5.—R. E. BATY & SON, Bank Top, Kenton, Newcastle-on-Tyne, for **Jim**, dark bay, bred by W. Atkinson, Bicks Farm, Cleator Moor, Cumberland; *s.* Abercromby Appin 19596.

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[1] Champion Silver Medal given by the Clydesdale Horse Society for the best Mare or Filly.

Class 20.—*Clydesdale Geldings, by registered sires, shown in a single turn-out.*

114 I. £20.—CORPORATION OF GLASGOW, CLEANSING DEPT., 20, Trongate, Glasgow, for Cart, roan, born in 1929, bred by R. Armstrong, Newbiggen, Kirklinton; *s.* Pickston 20801.

116 II. £10.—CORPORATION OF GLASGOW, for Craigton, roan, born in 1928, bred by W. Templeton, Broadfield, Wigtown; *s.* Woodruff 20838.

103 III. £5.—CORPORATION OF GLASGOW, for Carrick. (See Class 18).

115 IV. £3.—CORPORATION OF GLASGOW, for Clyde, bay, born in 1930, bred by Major Keith, Pitmedden, Udny; *s.* Craigie Winalot 21322.

102 R.N.—J. G. FAIRBAIRN, Ramrig, Duns, for Sergeant Fashion.

Class 21.—*Teams of Three or Four Clydesdale Horses, mares, geldings or mixed, in harness with vehicle.*

118 I. £10—CORPORATION OF GLASGOW, CLEANSING DEPT. Team of Four Geldings.

117 II. £5.—DORMAN, LONG & CO., LTD., Grange Hill, Bishop Auckland. Team of Four Geldings.

Specials.[1]—I. £10, DOUGLAS D. MURRAY; II. £5 and III. £3, divided between EDWARD NICHOL and T. SEYMOUR & SONS; IV. £1, divided between JAMES LITTLE, ROBERT TAYLOR and J. TOWNSON & SONS.

Suffolks.

Class 22.—*Suffolk Stallions, born in or before* 1931.[2]

126 I. £20 & Champion.[3]—DENNIS WALKER, Trowse, Norwich, for Lord Foch of Frithville 6174, born in 1929, bred by F. S. Fairweather, Whatfield, Ipswich; *s.* Sudbourne Foch 4869, *d.* Hadleigh Ceres 13598 *by* Ashmoor Cornsheaf 5286.

124 II. £10.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for Woolverstone Beaufort 6126, born in 1930, bred by J. A. Berners, Woolverstone, Ipswich; *s.* Fornham Beatty 4942, *d.* Ruby 10377 *by* Morston Gold Guard 4234.

125 III. £5.—DENNIS WALKER, for Holkham Pioneer 6120, born in 1928, bred by the Earl of Leicester, Holkham, Norfolk; *s.* Horstead Punchinello 5096, *d.* Holkham Primrose 12768 *by* Bawdsey Earl 4736.

121 R.N.—THE EXORS. OF THE LATE A. T. PRATT, Morston Hall, Trimley, Ipswich, for Worlingworth Bonfire.

Class 23.—*Suffolk Stallions, born in* 1932.

127 I. £20.—P. ADAMS & SONS, Laurel Farm, Felixstowe, for Kentish Hero 6400, bred by W. G. Harvey, Cloisters, Haygate Avenue, Southend; *s.* Martley King of Diamonds 5772, *d.* Martley La Premiere 13541 *by* Sudbourne Premier 4963.

132 II. £10.—THE EXORS. OF THE LATE A. T. PRATT, Morston Hall, Trimley, Ipswich, for Golden Grain of Morston 6296, bred by W. Kindred, Cransford, Suffolk; *s.* Woolverstone Gold Dust 5530, *d.* Park Stella 12723 *by* Mickfield Wedgewood 5088.

131 III. £5.—STUART PAUL, Kirton Lodge, Ipswich, for Harvester of Samford 6327, bred by William Pipe, Boyton Hall, Woodbridge; *s.* Horstead Vanguard 4784, *d.* Broxtead Princess 12265 *by* Framlingham Allenby 4826.

128 R.N.—THOMAS JOHN BAILEY, Hill Farm, Roxwell, Chelmsford, for Moulton Dastur.

Class 24.—*Suffolk Stallions, born in* 1933.

133 I. £20 & R.N. for Champion.[3]—R. H. & R. PAUL, Broxtead, Sutton, Woodbridge, for Broxtead Lawyer 6449; *s.* Broxtead Judex 6227, *d.* Nortonean Prude 12929 *by* Fakenham Peter 5053.

139 II. £10.—DENNIS WALKER, Trowse, Norwich, for Trowse Lord Foch 6389; *s.* Lord Foch of Frithville 6174, *d.* Surlingham Rose 13258 *by* General John 4657.

134 III. £5.—J. A. MARSDEN POPPLE, Daneshill, Stevenage, for Harken of Daneshill 6402, bred by E. S. Buck & Son, Raveningham, Norwich; *s.* Sudbourne Premier 4963, *d.* Hexton Constance 15724 *by* Shotley Counterpart 4903.

Class 25.—*Suffolk Stallions, born in* 1934.

143 I. £20.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for Wratting Emperor 6461; *s.* Red Gold of Wratting 5932, *d.* Wratting Empress 15236 *by* Bawdsey Emperor 5717.

140 II. £10.—CLEMENT COOK, Upland Hall Farm, Bungay, for Premier 6505; *s.* Sudbourne Premier 4963, *d.* Graceful 10406 *by* Kenton Angus 4639.

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[1] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham for most points awarded in a combination of entries in the Clydesdale Classes.

[2] Prizes given by the Suffolk Horse Society.

[3] The "Coronation" Perpetual Silver Challenge Cup given by the Suffolk Horse Society for the best Stallion.

141 III. £5.—THE HON. L. W. JOYNSON-HICKS, Newick Park, Sussex, for **Newick Dreadnought** 6496; *s.* Morston Connaught 4590, *d.* Darkie 10758 *by* Morston Gold Guard 4234.

Class 26.—*Suffolk Mares, with their own foals at foot.*

144 I. £20 & Champion.[1]—P. ADAMS & SONS, Laurel Farm, Felixstowe, for **Laurel Keepsake** 14926, born in 1928 [foal *by* Bawdsey Sir Roger 5970]; *s.* Shotley Counterpart 4903, *d.* Bawdsey Propriety 11355 *by* Bawdsey Hay 4188.
147 II. £10.—THE HON. L. W. JOYNSON-HICKS, Newick Park, Sussex, for **Newick Dawn** 15694, born in 1929 [foal *by* Morston Connaught 4590], bred by the late Viscount Brentford, Newick Park; *s.* Sudbourne K. 4692, *d.* Darkie 10758 *by* Morston Gold Guard 4234.
153 III. £5.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Nortonean Dinah** 11828, born in 1922 [foal *by* Red Gold of Wratting 5932], bred by J. T. Thistleton-Smith, Fakenham; *s.* Horstead Vanguard 4784, *d.* Diana 7640 *by* Bawdsey Harvester 3076.
149 R.N.—J. A. MARSDEN POPPLE, Danes Hill, Stevenage, for **Wildham Arabis.**
H.C.—154.

Class 27.—*Suffolk Colt Foals, the produce of Mares in Class* 26.[2]

157 I. £10.—P. ADAMS & SONS, Laurel Farm, Felixstowe, for foal, born April 3, 1935; *s.* Bawdsey Sir Roger 5970, *d.* Laurel Keepsake 14926 *by* Shotley Counterpart 4903.
160 II. £5.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for foal, born Feb. 5, 1935; *s.* Red Gold of Wratting 5932, *d.* Wratting Empress 15236 *by* Bawdsey Emperor 5717.
159 III. £3.—J. A. MARSDEN POPPLE, Daneshill, Stevenage, for foal, born March 3, 1935; *s.* Boulge Rodney 6047, *d.* Wildham Arabis 15628 *by* Bawdsey Kwang Su 5700.

Class 28.—*Suffolk Filly Foals, the produce of Mares in Class* 26.[2]

164 I. £10.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for foal, born Feb. 9, 1935; *s.* Red Gold of Wratting 5932, *d.* Nortonean Dinah 11828 *by* Horstead Vanguard 4784.
165 II. £5.—FRANK SAINSBURY, for foal, born April 18, 1935; *s.* Bawdsey Dear Sir 6228, *d.* Wratting Nancy 16372 *by* Worlingham Red Gold 5506.
161 III. £3.—THE EARL OF IVEAGH, C.B., C.M.G., Pyrford Court, Woking, for foal, born April 2, 1935; *s.* Rushmere Ringleader 6040, *d.* Pyrford Pearl 15837 *by* Pyrford Paul 5793.
162 R.N.—THE HON. L. W. JOYNSON-HICKS, Newick Park, Sussex.

Class 29.—*Suffolk Mares, born in or before* 1931, *not having a foal at foot. A Mare* 6 *years old or over must have produced a live foal in* 1934 *or* 1935.

168 I. £15 & R.N. for Champion.[1]—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Vignette** 15656, born in 1929 [filly foal born March 15, 1935, *by* Red Gold of Wratting 5932], bred by W. H. Allen, Harkstead Hall, Ipswich; *s.* Fornham Beatty 4942, *d.* Lilly 10770 *by* Sudbourne Beauchief 4215.
167 II. £10.—FRANK SAINSBURY, for **Ursula** 15235, born in 1928 [filly foal born April 9, 1934, *by* Red Gold of Wratting 5932], bred by W. H. Allen, Harkstead Hall, Ipswich; *s.* Fornham Beatty 4942, *d.* Marigolds Bloom 11469 *by* Woolverstone Checkmate 4683.

Class 30.—*Suffolk Fillies, born in* 1932.

173 I. £20.—FRED WALKER, Broadmead, Burston, Horley, for **Sutton Star** 16660, bred by R. A. Forrest, Sutton, Woodbridge; *s.* Bawdsey Martian 6029, *d.* Raveningham Dawn 11757 *by* Sudbourne Foch 4869.
172 II. £10.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Elmah of Wratting** 16863, bred by S. E. Cordle, Hill Farm, Chelmondiston, Ipswich; *s.* Riddlesworth Satrap 6048, *d.* Blossom 10310 *by* Woolverstone Checkmate 4683.
169 III. £5.—R. H. & R. PAUL, Broxtead, Sutton, Woodbridge, for **Broxtead Julia** 16808; *s.* Horstead Vanguard 4784, *d.* Swardeston Jiffy 1227 *by* Sudbourne Chieftain 5029.

Class 31.—*Suffolk Fillies, born in* 1933.

176 I. £20.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Wratting Marigold** 17426; *s.* Red Gold of Wratting 5932, *d.* Rushmere Marguerite 14871 *by* Tattingstone Beau Esprit 4927.
174 II. £10.—P. ADAMS & SONS, Laurel Farm, Felixstowe, for **Laurel Golden Girl** 17217; *s.* Bawdsey Sir Roger 5970, *d.* Laurel Beauty 15361 *by* Shotley Counterpart 4903.
175 III. £5.—E. S. BUCK & SON, Sycamore Farm, Raveningham, Norwich, for **Woolverstone Bonnie** 17279, bred by Major J. A. Berners, Woolverstone Park, Suffolk; *s.* Riddlesworth Satrap 6048, *d.* Woolverstone Beatrice 15465 *by* Woolverstone Gold Dust 5530.

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[1] Champion Prize of £10 given by the Suffolk Horse Society for the best Mare or Filly.
[2] Prizes given by the Suffolk Horse Society.

Class 32.—*Suffolk Fillies, born in* 1934.

179 I. £20.—E. S. BUCK & SON, Sycamore Farm, Raveningham, Norwich, for **Raveningham Arabelle** 17919; *s.* Sudbourne Premier 4963, *d.* Hexton Constance 15724 *by* Shotley Counterpart 4903.
178 II. £10.—THOMAS JOHN BAILEY, Hill Farm, Roxwell, Chelmsford, for **Roxwell Lady** 17538; *s.* Riddlesworth Satrap 6048, *d.* Morston Counter Peace 2nd 15710 *by* Shotley Counterpart 4903.
181 III. £5.—THE EXORS. OF THE LATE A. T. PRATT, Morston Hall, Trimley, Ipswich, for **Morston Bloom** 18001; *s.* Tattingstone Beau Esprit 4927, *d.* Morston Faithful 13177 *by* Shotley Counterpart 4903.
180 R.N.—STUART PAUL, Kirton Lodge, Ipswich, for **The Marne**.

Class 33.—*Suffolk Geldings, by registered sires, born in or before* 1932.[1]

185 I. £20.—STUART PAUL, Kirton Lodge, Ipswich, for **Captain**, born in 1930, bred by C. P. Runnacles, Brockdish Grove, Diss; *s.* Admiral John 5127, *d.* Reydon Diamond 13474 *by* Framlingham Beau 4737.
191 II. £10—STUART PAUL, for **Smiler**, born in 1928, bred by H. S. Horne, Aldsworth Farm, Emsworth; *s.* General John 4657.
189 III. £5.—STUART PAUL, for **Major**, born in 1931, bred by Frank Warren, Godbolts, Marks Tey; *s.* Godbolts Hero 6027, *d.* Bonnie Sheika 11467 *by* Darsham Sheik 4129.
182 R.N.—E. S. BUCK & SON, Sycamore Farm, Raveningham, Norwich, for **Duke**.
H.C.—183, 186.

Class 34.—*Teams of Three or Four Suffolk Horses, mares, geldings or mixed, in harness with vehicle.*

195 I. £10.—FRANK SAINSBURY, for Team of Four Mares.
193 II. £5.—STUART PAUL, for Team of Four Geldings.

Percherons.

Class 35.—*Percheron Stallions, born in or before* 1932.

200 I. £20 & Champion.[2]—DUNCAN M. STEWART, Millhills, Crieff, for **Histon Drayman 9th** B. 410, light grey, born in 1927, bred by Chivers & Sons, Ltd., Histon, Cambridge; *s.* Lagor B. 1, *d.* Prolifere B. 191 *by* Jugal F. 85444.
196 II. £10 & R.N. for Champion.[2]—CHIVERS & SONS, LTD., Histon, Cambridge, for **Coldham Gunner** B. 208, grey, born in 1922, bred by Col. H. E. Hambro, Coldham Hall, Bury St. Edmunds; *s.* Quanteleux B. 35, *d.* Pandata B. 130 *by* Lutecien F. 102720.
198 III. £5.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Echevin** B. 574, grey, born in 1926, bred by M. Champion, Mortagne, France; *s.* Vassal F. 154217, *d.* Alma F. 159437 *by* Remonteur F. 13455.
201 R.N.—JOHN H. TURNER, Westwood, Sevenoaks Weald, for **Aldenham Warrior**.

Class 36.—*Percheron Stallions, born in* 1933.

202 I. £20 & R.N. for Champion.[3]—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Clansman** B. 599, dark grey; *s.* Cense B. 409, *s.* Stourhead Nerondes B. 828 *by* Lagor B. 1.
203 II. £10.—MISS R. M. HARRISON, O.B.E., Maer Hall, Newcastle, Staffs., for **Histon Bold Boy** B. 598, dark grey, bred by Chivers & Sons, Ltd., Histon, Cambridge; *s.* Cense B. 409, *d.* Defiance B. 854 *by* Ramoneur F. 133946.
204 III. £5.—SIR HENRY H. A. HOARE, BART., Stourhead, Zeals, Wilts, for **Stourhead Geg** B. 579, grey; *s.* Stourhead Lagor B. 424, *d.* Tirelire B. 434 *by* Instar F. 78857.

Class 37.—*Percheron Stallions, born in* 1934.

205 I. £20 & Champion.[3]—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Brilliant Boy** B. 628, dark grey; *s.* Histon Drayman 4th B. 340, *d.* Histon Lady 2nd B. 375 *by* Brilliant H. B. 375.
208 II. £10.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Aldenham Servitor** B. 618, dark grey; *s.* Orton Misanthrope B. 474, *d.* Serverie B. 534 *by* Importun F. 80576.
207 III. £5.—SYDNEY J. COLE, Heywood Hall, Diss, for **Aldenham Monarch**, dark grey, bred by J. Pierpont Morgan, Wall Hall, Aldenham, Watford; *s.* Orton Misanthrope B. 474, *d.* Greyling Welcome B. 443 *by* Rhum B. 53.
206 R.N.—CHIVERS & SONS, LTD., for **Histon Gay Lad**.

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[1] Prizes given by the Suffolk Horse Society.
[2] Perpetual Silver Challenge Cup given by the British Percheron Horse Society for the best Stallion.
[3] Perpetual Silver Challenge Cup given by the British Percheron Horse Society for the best Stallion in Classes 36 and 37 born in Great Britain.

Class 38.—*Percheron Mares, with their own foals at foot.*

209 I. £20 & Champion.[1]—THE BIRDSALL ESTATES CO. LTD., Birdsall, Malton, for **Grosse** B. 1136, dark grey, born in 1928 [foal *by* Cense B. 409], bred by M. Durand, Montagne, France; *s.* Apre F. 155094, *d.* Craneuse F. 165899 *by* Souvenons F. 136704.

212 II. £10 & R.N. for Champion.[1]—CHIVERS & SONS, LTD., Histon, Cambridge, for **Iodee** B. 1171, grey, born in 1930 [foal *by* Duverner B. 573], bred by M. Jardin, Nogent le Retrou, France; *s.* Dolichotis F. 173216, *d.* Dryade F. 172453 *by* Ulric F. 146915.

216 III. £5.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Florence** B. 1024, grey, born in 1927 [foal *by* Histon Drayman 4th B. 340], bred by Madame Vve. Barin, Mamers, France; *s.* Quaiman F. 129648, *d.* Partition F. 127469 *by* Importun F. 80576.

215 R.N.—J. PIERPONT MORGAN, for **Escargole.**
H.C.—211.

Class 39.—*Percheron Colts or Filly Foals, the produce of Mares in Class* 38.

219 I. £10.—THE BIRDSALL ESTATES CO. LTD., Birdsall, Malton, for **Birdsall Gracchus**, dark grey colt, born March 26, 1935; *s.* Cense B. 409, *d.* Grosse B. 1136 *by* Apre F. 155094.

220 II. £5.—CHIVERS & SONS, LTD., Histon, Cambridge, for colt, born April 14, 1935; *s.* Duverner B. 573, *d.* Iodee B. 1171 *by* Dolichotis F. 173216.

223 III. £3.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for dark grey filly, born April 4, 1935; *s.* Histon Drayman 4th B. 340, *d.* Florence B. 1024 *by* Quaiman F. 129648.

224 R.N.—WILLIAM PARKIN-MOORE, Whitehall, Mealsgate, Cumberland, for grey filly.

Class 40.—*Percheron Mares, not having a foal at foot, or Fillies, born in or before* 1932. *A Mare* 6 *years old or over must have produced a live foal in* 1934 *or* 1935.[2]

225 I. £20.—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Rosalind** B. 1046, light grey, born in 1931; *s.* Cense B. 409, *d.* Rovigno B. 256 *by* Mylord B. 275.

228 II. £10.—WILLIAM PARKIN-MOORE, Whitehall, Mealsgate, Cumberland, for **Whitehall Vanessa** B. 1092, grey, born in 1932; *s.* Whitehall Amor B. 526, *d.* Variante B. 515 *by* Quatalpa F. 129873.

227 III. £5.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Jaspure** F. 197700, grey, born in 1931, bred by M. Fourmoni, Mortgague; *s.* Tactere F. 180103, *d.* Orcanne F. 158875 *by* Quonpromise F. 123021.

Class 41.—*Percheron Fillies, born in* 1933.

229 I. £20 & Champion.[3]—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Charm** B. 1187, light grey; *s.* Carburateur B. 403, *d.* Histon Beauty 4th B. 878 *by* Villabon B. 276.

230 II. £10 & R.N. for Champion.[3]—CHIVERS & SONS, LTD., for **Histon Reverie** B. 1194, light grey; *s.* Cense B. 409, *d.* Histon Trip B. 279 *by* Oremus B. 13.

231 III. £5.—ROBERT CHRYSTAL IRVING, Shenley Lodge, Ridge Hill, Barnet, for **Erpingham Xanthia** B. 1164, dark grey, bred by Robert Ives, Erpingham House, Erpingham, Norfolk; *s.* Stourhead Thor B. 448, *d.* Greyling Xanthia B. 503 *by* Rhum B. 53.

232 R.N.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Aldenham Beautiful.**

Class 42.—*Percheron Geldings, by registered sires, born in or before* 1932.[2]

234 I. £20.—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Prince**, light grey, born in 1928; *s.* Villabon B. 276.

233 II. £10.—CHIVERS & SONS, LTD., for **Histon Major**, grey, born in 1927; *s.* Lagor B. 1.

236 III. £5.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Stourhead Fernand** B. 273, grey, born in 1923, bred by Sir Henry H. A. Hoare, Bart, Stourhead, Zeals; *s.* Stourhead Original B. 82, *d.* Finette B. 38 *by* Pinson F. 63112.

235 R.N.—J. PIERPONT MORGAN, for **Peter.**
H.C.—238, 241.

Class 43.—*Teams of Three or Four Percheron Horses, stallions, mares, geldings or mixed, in harness with vehicle.*

242 I. £10.—CHIVERS & SONS, LTD., for Team of Four Horses.

243 II. £5.—COL. H. E. HAMBRO, C.B.E., for Team of Four Horses.

245 III. £3.—C. VAUX & SONS, LTD., Castle Street Brewery, Sunderland, for Team of Four Horses.

244 R.N.—J. PIERPONT MORGAN, for Team of Four Horses.

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[1] Perpetual Silver Challenge Cup given by the British Percheron Horse Society for the best Mare or Filly.

[2] Prizes given by the British Percheron Horse Society.

[3] Perpetual Silver Challenge Cup given by the British Percheron Horse Society for the best Filly born in Great Britain.

Hunters.

Class 44.—*Hunter Geldings, born in* 1932.

246 I. £20.—SIR JOHN WM. BUCHANAN-JARDINE OF CASTLEMILK, BART., Castle Milk, Lockerbie, for **Hasty Bob 1694**, chestnut; *s.* Hot Haste, *d.* Miss Colling 7650.
249 II. £10.—R. B.-COLTON-FOX, Burythorpe House, Malton, for **Knock Out** (Supp. No. 1813), chestnut; *s.* Knockling Boy, *d.* Dawn.
258 III. £5.—CAPT. C. D. LEYLAND, Camp Hill, Bedale, for **Sydney Bridge**, bay; *s.* Corbridge.
256 IV. £4.—JOHN EDWARD JONES, Treworgan, Llangrove, Hereford, for **Cavalcade** (Supp. No. 1847), bay, bred by Miss Joan Lysley, Chippenham; *s.* Bardsey, *d.* Sweet Pepper 2nd 7457 *by* Brandimintine.

254 R.N.—J. R. HINDLEY, Moorlands, Blacko, Nelson, Lancs., for **Gallant.**

Class 45.—*Hunter Geldings, born in* 1933.

266 I. £20.—JOHN EDWARD JONES, Treworgan, Llangrove, Hereford, for **Royal Flush** (Supp. No. 1848), bay, bred by Miss Joan Lysley, Chippenham; *s.* Bardsey, *d.* 7457 Sweet Pepper 2nd *by* Brandimintine.
273 II. £10—MRS. W. HARCOURT WEBB, Spring Grove, Bewdley, for **Pay Day** (Supp. No. 1839), bay; *s.* Bhuidhaonach, *d.* Lady Day *by* Marint.
272 III. £5.—MR. AND MRS. T. R. V. RENTON, Paddock House, Starbeck, Yorks., for **Lucifer**, brown, bred by T. Kirby, Helperthorpe, Yorks.; *s.* Match, *d. by* Snapdragon.

264 R.N.—MAJOR CLIVE BEHRENS, Swinton Grange, Malton, for **Kitchener.**

Class 46.—*Hunter Colts or Geldings, born in* 1934.

279 I. £20.—MAJOR GORDON B. FOSTER, Leysthorpe, Oswaldkirk, York, for **Firefly**, chestnut gelding; *s.* Aynsley, *d.* 7464 Dragon Fly *by* Dunholm.
283 II. £10.—MRS. HOWARD MANDER, Trysull Manor, Wolverhampton, for **Cornelius** (Supp. No. 1889), chestnut colt, bred by Major H. C. Meredith, Broadward Hall, Aston-on-Clun; *s.* Bhuidhaonach, *d.* 7518 Cornelia 2nd *by* Red Sahib 75.
278 III. £5.—C. B. CHARTRES, Mindrum, Northumberland, for **Minboul** (Supp. No. 1875), chestnut colt; *s.* Boulevardier (Vol. 26, p. 343), *d.* 6693 Mindibs *by* Dibs (Vol. 21, p. 315).

274 R.N.—MAJOR CLIVE BEHRENS, Swinton Grange, Malton, for **Swinton Honour Bright**

Class 47.—*Hunter Fillies, born in* 1932.

285 I. £20 & R.N. for Champion.[1]—MISS NANCY BURY, Millichope Park, Craven Arms, for **8049 Mereton**, grey roan, bred by Mrs. Bury; *s.* Tonton, *d.* 8151 Merry Marriage *by* Kithogue.
290 II. £10.—THOS. & HY. WARD, Pinchinthorpe, Guisborough, for **8050 Bellidore**, brown; *s.* Lodore, *d.* Bellicent *by* Invincible.
287 III. £5.—R. B.-COLTON-FOX, Burythorpe House, Malton, for **Greta**, chestnut; *s.* Knocklong Boy, *d.* Gretna *by* Radium.

286 R.N.—C. B. CHARTRES, Mindrum, Northumberland, for **Mincora.**

Class 48.—*Hunter Fillies, born in* 1933.

294 I. £20 & Champion.[1]—J. STEEL, Kirkwood, Lockerbie, for **8203 Speedway**, brown *s.* Hot Haste, *d.* Dinah.
291 II. £10.—HENRY HALL, Whitchester, Heddon, Newcastle-on-Tyne, for **Gold Dust**, chestnut bay; *s.* Ilston.
292 III. £5.—JOHN W. HEMINGWAY, Ingmanthorpe Hall, Kirk Deighton, Wetherby, for **Easby Primrose**, bay; *s.* Erehwemos, *d.* Blue Bead *by* Adam Bede.

293 R.N.—JOHN HUNTER, Brockdam, Chathill, for **Honeymug.**

Class 49.—*Hunter Fillies, born in* 1934.

296 I. £20.—MISS THOMSON CURRIE, Clatto, Cupar, Fife, for **Millbridge**, chestnut; *s.* Corbridge, *d.* 6032 Meg Merrilies *by* Moonlighter.
295 II. £10.—MAJOR CLIVE BEHRENS, Swinton Grange, Malton, for **8295 Swinton Sheila**, bay brown; *s.* Warrington, *d.* 5703 Swinton Salome *by* Jovial.
302 III. £5.—H. H. WELLBURN, Low Farm, Pinchinthorpe, Guisborough, for **Cordelia**, brown; *s.* Periosteum, *d.* 6309 Lady Scott 2nd *by* Flying Scott.

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[1] Champion Gold Medal given by the Hunters' Improvement and National Light Horse Breeding Society for the best Filly under four years old, which must be either registered in the Hunter Stud Book, or the entry tendered within a month of the Award.

Class 50.—*Hunter Mares, with their own foals at foot.*

305 I. £20 & R.N. for Champion.[1]—J. W. HEMINGWAY, Ingmanthorpe Hall, Kirk Deighton, Wetherby, for 7540 **Whorlton Lass**, bay, born in 1928 [foal *by* Erehwemos], bred by J. J. Emerson, Easby Hall, Great Ayton; *s.* Periosteum, *d.* Jane *by* Jack Scarlett.
306 II. £10.—MRS. HOWARD MANDER, Trysull Manor, Wolverhampton, for 7275 **Rose Mary 5th**, brown, born in 1928 [foal *by* Pal-o'-Mine], bred by W. B. Brown, Slingsby, Yorks.; *s.* Dunholm, *d.* 6570 Proud Mary *by* Proudridge.

Class 51.—*Hunter Mares (Novice), with their own foals at foot.*

312 I. £20 & Champion.[1]—SIR MERRIK R. BURRELL, BART., C.B.E., Estate Office, Knepp Castle, Horsham, for 6486 **Chime 2nd**, brown, born in 1924 [foal *by* Herodote]; *s.* The Best 147, *d.* 5330 The Belle *by* Hanover Square.
315 II. £10.—MRS. HOWARD MANDER, Trysull Manor, Wolverhampton, for **Gaiety** brown, aged [foal *by* Pal-o'-Mine], bred by E. Kimbell, The Grange, Great Brington, Northampton; *s.* Snap Dragon.

Class 52.—*Hunter Colt Foals, the produce of Mares in Classes* 50 *or* 51.

[No Exhibits.]

Class 53.—*Hunter Filly Foals, the produce of Mares in Classes* 50 *and* 51.

325 I. £15.—MRS. HOWARD MANDER, Trysull Manor, Wolverhampton, for **Gay Lass**, brown, born April 2, 1935; *s.* Pal-o'-Mine, *d.* Gaiety *by* Snap Dragon.
326 II. £10.—MRS. HOWARD MANDER for **Mary Ann**, brown, born Feb. 20, 1935; *s.* Pal-o'-Mine, *d.* 7275 Rose Mary 5th *by* Dunholm.

Specials.[2]—I. £10, C. B. CHARTRES; II. £5, HENRY HALL; III. £3 & IV. £1, divided between JOHN HUNTER and JOHN C. STRAKER.

Special Produce Prizes of £3 each (First Prizes) given by the R.A.S.E. and £1 each (Second Prizes) by the Hunters' Improvement and National Light Horse Breeding Society for the two best groups of three young animals in Classes 44 to 49, by the same Thoroughbred or Registered Hunter Sire. A Gold Medal was given by the H.I. & N.L.H.B.S. to the owner of the sire of the winning group, and a Silver Medal to the owner of the sire of the second prize group.

Sired by HOT HASTE.

246 **Hasty Bob**, chestnut gelding, exhibited by SIR J. W. BUCHANAN-JARDINE, BART.
276 **Gingerbread 2nd**, chestnut gelding, exhibited by SIR J. W. BUCHANAN-JARDINE, BART.
294 **Speedway**, brown filly, exhibited by J. STEEL.

Sired by CORBRIDGE.

258 **Sydney Bridge**, bay gelding, exhibited by CAPT. C. D. LEYLAND.
286 **Mincora**, chestnut filly, exhibited by C. B. CHARTRES.
296 **Millbridge**, chestnut filly, exhibited by MISS THOMSON CURRIE.

Polo and Riding Ponies.

Class 54.—*Polo and Riding Pony Stallions, born in or before* 1932.

327 I. £20 & Champion.[3]—H. BRIGHT, The Cove, Silverdale, Carnforth, for **Silverdale Tarragon** 1918, chestnut, born in 1930; *s.* Tabarin 1682, *d.* 3388 Bowery *by* Bowden.
329 II. £10 & R.N. for Champion.[3]—LORD GREENWAY, 56, Palace Court, London, W., for **Rialto Bridge** 1876, dark chestnut, born in 1925, bred by H. H. Collins; *s.* Noblesse Oblige, *d.* Sunny Florence *by* Sundridge.

Class 55.—*Polo and Riding Pony Colts, Fillies or Geldings, born in* 1934.

332 I. £20 & R.N. for Champion.[4]—H. BRIGHT, The Cove, Silverdale, Carnforth, for **Silverdale Lockstitch** (Supp. 1934), bay filly, bred by A. Bennett, Halforth Farm, Heversham; *s.* Silverdale Cheerio 1320, *d.* Lochranza A.M.R. 355 *by* Loch Ryan.
333 II. £10.—CAPT. FRANCE-HAYHURST, Bostock Hall, Middlewich, for **Silver Grit** (Supp. 1934), dark brown colt; *s.* Silverdale Loyalty 1448, *d.* 5290 Silver Sheen 2nd *by* Sheen Lad (Vol. 24, p. 697).

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[1] Champion Gold Medal given by the Hunters' Improvement and National Light Horse Breeding Society for the best Mare four years old and upwards, which must be either registered in the Hunter Stud Book, or the entry tendered within a month of the Award.

[2] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the Hunter Breeding Classes.

[3] Champion Gold Medal given by the National Pony Society for the best Stallion or Colt.

[4] Champion Silver Medal given by the National Pony Society for the best Filly.

331 III. £5.—H. BRIGHT, for **Silverdale Credo** (Supp. 1934), bay colt; *s.* Silverdale Loyalty 1448, *d.* 5073 Silverdale Faith *by* Cherry Tint.

334 R.N.—TRESHAM GILBEY, Whitehall, Bishop's Stortford, for **Marina 2nd.**

Class 56.—*Polo and Riding Pony Colts, Fillies or Geldings, born in* 1933.

336 I. £20.—H. BRIGHT, The Cove, Silverdale, Carnforth, for **Silverdale Bowman** (Supp. 1933), bay colt; *s.* Silverdale Bowtint (Supp. 1926), *d.* 4168 Silvery 2nd *by* Right For'ard 368.

337 II. £10.—CAPT. FRANCE-HAYHURST, Bostock Hall, Middlewich, for **Lady Grey 4th** (Supp. 1933), grey filly; *s.* Four Up, *d.* 6026 Rosine *by* Rosewood 1314.

Class 57.—*Polo and Riding Pony Fillies or Geldings, born in* 1932.

341 I. £20, Champion[1] & R.N. for Champion.[2]—CAPT. FRANCE-HAYHURST, Bostock Hall, Middlewich, for **Rosina 2nd** (Supp. 1932), chestnut filly; *s.* Silverdale Loyalty 1448, *d.* 6026 Rosine *by* Rosewood 1314.

339 II. £10.—H. BRIGHT, The Cove, Silverdale, Carnforth, for **Silverdale Truepenny** (Supp. 1932), chestnut gelding; *s.* Silverdale Loyalty 1448, *d.* 3388 Bowery *by* Bowdon.

340 III. £5.—MISS B. G. CORY-WRIGHT, Norcott Hill, Berkhamsted, for **Fair Harriet** (Y.S.B., p. 138), chestnut filly; *s.* Gold Eagle (Y.S.B., p. 36), *d.* Harietta (A.M.B., p. 317) *by* Sir Harry.

338 R.N.—H. BRIGHT, for **Silverdale Aquarelle.**

Class 58.—*Polo and Riding Pony Mares, with their own foals at foot.*

344 I. £20, Champion[2] & Champion.[3]—CAPT. FRANCE-HAYHURST, Bostock Hall, Middlewich, for **6026 Rosine**, chestnut, born in 1925 [foal by Silverdale Loyalty 1448]; *s.* Rosewood 1314, *d.* 5032 Juliet 2nd *by* Sandiway 121.

343 II. £10 & R.N. for Champion.[3]—MISS B. G. CORY-WRIGHT, Norcott Hill, Berkhamsted, for **Falloch Ashore** (A.M.B., p. 193) chestnut, born in 1922 [foal *by* Ethelwulf 1827], bred by Mrs. M. Hughes, Ireland; *s.* Count Anthony, *d.* Gay Falloch *by* Gay Man.

346 III. £5.—LORD GREENWAY' 56, Palace Court, London, W., for **Grey Glove** (A.M.B. p. 444), grey, born in 1928 [foal *by* Malice].

Dales Ponies.

Class 59.—*Registered Dales Pony Stallions.*

347 I. £10.—J. W. DALTON, Snowhope Close, Stanhope, Co. Durham, for **Snowhope Purple Heather 1929**, brown, born in 1929, bred by R. G. Spensley, Howe Syke, Thoralby, Leyburn; *s.* Mountain Jester, *d. by* Pendragon Comet 974.

348 II. £5.—THOMAS IRELAND, Stoneraise, Threlkeld, Keswick, for **Rising Star 11846**, brown, born in 1926, bred by J. Hauxwell, Paradise Farm, Woodland; *s.* Brown Jock, *d.* Woodland Jess *by* Dalesman 572.

Class 60.—*Registered Dales Pony Mares, with their own foals at foot by registered Dales Pony Stallions.*[4]

351 I. £10.—J. W. DALTON, Snowhope Close, Stanhope, Co. Durham, for **5131 Snowhope Beauty**, black, born in 1922 [foal *by* Snowhope Heather 1663], bred by J. Winder, Greenside, Ravenstonedale; *s.* Yorkshire Fashion, *d.* 5447 Greenside Beauty *by* British Boy 574.

352 II. £5.—J. W. DALTON, for **5806 Snowhope Perfection**, black, born in 1925 [foal *by* Snowhope Heather 1663], bred by R. Sayer, Mount Clifton, Penrith; *s.* Dalesman 572, *d.* Perfection *by* Bendle Squire.

353 III. £3.—J. GRAHAM, Burnt Hills, Wearhead, for **6658 Black Beauty 5th**, black, born in 1928 [foal *by* Sonny Boy 2nd 1877], bred by W. Hully, Tebay, Westmorland.

Special Prizes of £5 (First Prize), £4 (Second Prize), and £3 (Third Prize) given by the Dales Improvement Society for the best Groups of three Dales or Highland Ponies in Classes 59, 60, 64 and 65.

The Groups need not be the property of one owner, and, in case of separate ownership of animals in a group, the Prizes to be divided in accordance with ownership.

347	I.	**Snowhope Purple Heather**, shown by J. W. DALTON.
351		**Snowhope Beauty** ,, ,, ,,
352		**Snowhope Perfection**, ,, ,, ,,

[1] Champion Silver Medal given by the National Pony Society for the best Filly.
[2] Champion Gold Medal given by the National Pony Society for the best Mare or Filly.
[3] Bronze Medal given by the National Pony Society for the best Foal in Class 58 entered in the Supplement to the National Pony Stud Book.
[4] Prizes given by the Dales Pony Improvement Society.

Fell Ponies.

Class 61.—*Registered Fell Pony Stallions, not exceeding* 14 *hands.*

357 I. £10.—ROY B. CHARLTON, The Linnels, Hexham, for **Linnel Lingcropper 1621**, black, born in 1928; *s.* Linnel Boy 1260, *d.* 5650 Linnel Heather Bell *by* Blooming Heather 3rd 670.
356 II. £5.—ROY B. CHARLTON, for **Linnell Gallant Boy 1704**, black, born in 1930; *s.* Linnel Mite 1460, *d.* 5642 Linnel Fluff *by* Linnel Moor Boy 1441.
358 III. £3.—JOSEPH WILLIAM DENT, Fair View, Middleton-in-Teesdale, for **Linnel Timothy 1838**, black, born in 1932, bred by Roy B. Charlton, The Linnels, Hexham; *s.* Linnel Lingcropper 1621, *d.* 3722 Linnel Fancy *by* Dalesman 572.
355 R.N.—J. W. BRUNSKILL, Hardendale Hall, Hardendale, Shap, Penrith, for **Hardendale Model.**
H.C.—359.

Class 62.—*Registered Fell Pony Mares, with their own foals at foot by registered Fell Pony Stallions, not exceeding* 14 *hands.*[1]

365 I. £10.—ROY B. CHARLTON, The Linnels, Hexham, for **6671 Linnel Firespark**, black, born in 1929 [foal *by* Linnel Lingcropper 1621], bred by the late Mr. Hutchinson, The Flosh, Blencarn; *s.* Moor Bradley 1476, *d.* 3812 Harvest *by* Black Boy.
364 II. £5.—ROY B. CHARLTON, for **5887 Linnel Bunty**, black, born in 1928 [foal *by* Linnel Lingcropper 1621]; *s.* Tweddle Hero 1343, *d.* 4177 Bess of Hardendale *by* Dalesman 572.
362 III. £3.—ROY B. CHARLTON, for **6073 Linnel Betty**, black, born in 1930 [foal *by* Linnel Lingcropper 1621]; *s.* Linnel Mite 1460, *d.* 4995 Linnel Bess *by* Mountain Ranger 598.
360 R.N.—JOHN BELLAS & SONS, Moor Farm, Keswick, for **Moor Daisy 4th.**
H.C.—366.

Class 63.—*Registered Fell Pony Fillies, born in* 1933 *or* 1934.[2]

371 I. £10.—JOSEPH WILLIAM DENT, Fair View, Middleton-in-Teesdale, for **Monks Bess 2nd**, black, born in 1933; *s.* Linnel Gallant Boy 1704.
373 II. £5.—JOSEPH WILLIAM DENT, for **Monks Fanny 2nd**, black, born in 1933; *s.* Linnel Gallant Boy 1704.
369 III. £3.—ROY B. CHARLTON, The Linnels, Hexham, for **6673 Linnel Marina**, black, born in 1934; *s.* Linnel Gallant Boy 1704, *d.* 3775 Robinson's Gipsy *by* Dalesman 572.
368 R.N.—ROY B. CHARLTON, for **Linnel Dainty 2nd.**
H.C.—375.

Special Prizes of £5 (First Prize), £4 (Second Prize), and £3 (Third Prize) given by the Fell Pony Society for the best Groups of three Fell Ponies in Classes 61 to 65.

The Groups need not be the property of one owner, and, in case of separate ownership of animals in a Group, the Prizes to be divided in accordance with ownership.

357	I.	**Linnel Lingcropper**,	shown by ROY B. CHARLTON.
378		**Linnel Caesar**,	,, ,, ,,
381		**Linnel Winsome**,	,, by MRS. R. B. CHARLTON.
358	II.	**Linnel Timothy**,	shown by J. W. DENT.
367		**Monks Bess 2nd**,	,, ,, ,,
371			
373		**Monks Fanny 2nd**,	,, ,, ,,
356	III.	**Linnel Gallant Boy**,	shown by ROY B. CHARLTON.
362		**Linnel Betty**,	,, ,, ,,
364		**Linnel Bunty**,	,, ,, ,,

Mountain or Moorland Ponies.

To be shown in saddle.

Class 64.—*Mountain or Moorland Ponies, not exceeding* 14 *hands, registered in the Dales, Fell or Highland Section of the National Pony Stud Book.*

384 I. £10.—MISS NORAH MACKENZIE, Rickmansworth Riding School Hunting Stables, Rickmansworth, for **Isleman 2nd**, cream dun Highland stallion, born in 1932, bred by J. H. Munro Mackenzie, Calgary, Isle of Mull; *s.* Tor Lochan 1774, *d.* 3064 Moisgeir *by* Shan Darach 648.

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[1] Prizes given by the National Pony Society.
[2] Prizes given by the Fell Pony Society.

382 II. £5.—MRS. F. C. CLEMENT, Linnel Dene, Hexham, for 6695 **Linnel Brown Girl**, brown Fell mare, born in 1928, bred by Messrs. Raine, Thornhope, Slaggyford, Northumberland; *s.* Alston Comet 1063, *d.* 6694 Raines Jess.
379 III. £3.—ROY B. CHARLTON, The Linnels, Hexham, for 6075 **Linnel Fan**, black Fell mare, born in 1930; *s.* Linnel Mite 1460, *d.* 3722 Linnel Fancy *by* Dalesman 572.
381 IV. £2.—MRS. R. BLACKETT CHARLTON, Linnel Wood, Hexham, for 6694 **Linnel Winsome**, black Fell mare, born in 1931, bred by the late Mr. Hutchinson, The Fiosh Westmorland; *s.* Mountain Jester 1409, *d.* 4497 Hazel 3rd *by* Highland Fashion 612
376 R.N.—MRS. W. E. BURNESS, Haylings House, Denham, Bucks, for **Tasisker 2nd**.
H.C.—377.

Class 65.—*Mountain or Moorland Ponies, over* 14 *hands, registered in the Dales, Fell or Highland Section of the National Pony Stud Book.*

395 I. £10.—ALEXANDER THAIN, Sunniside Farm, Hexham, for **Sunny Boy**, dark bay Dales gelding, born in 1928.
390 II. £5.—R. BLACKETT CHARLTON, JUNR., Linnel Wood, Hexham, for **Linnel Affection**, black Dales mare, born in 1930.
392 III. £3.—LADY FAIRFAX-LUCY, Maxton, St. Boswells, for **Donald Beg**, brown Highland gelding, born in 1924.
391 R.N.—J. W. DALTON, Snowhope Close, Stanhope, Co. Durham, for **Fairy Queen**.

Welsh Mountain Ponies.

Class 66.—*Welsh Mountain Pony Stallions, born in or before* 1932.

397 I. £15.—TOM JONES EVANS, Dinchope Farm, Craven Arms, for **Grove Sprightly** 1036, grey, born in 1918, bred by Mrs. H. D. Greene, Grove, Craven Arms; *s.* Bleddfa Shooting Star 73, *d.* 4431 Grove Sprite 2nd *by* Grove Ballistite 200.
398 II. £10.—TOM JONES EVANS, for **Grove Will o' the Wisp** 1260, grey, born in 1923, bred by Mrs. H. D. Greene, Grove, Craven Arms; *s.* Bleddfa Shooting Star 73, *d.* 3017 Grove Twilight *by* Grove Ballistite 200.
396 III. £5.—JOHN JONES & SON, Dinarth Hall, Colwyn Bay, for **Bowdler Bright Light** 1303, grey, born in 1923, bred by G. Preece, Hope Bowdler, Church Stretton; *s.* Mathrafal Havoc 909, *d.* 6880 Bowdler Bounce *by* Dyoll Satellite 386.

Class 67.—*Welsh Mountain Pony Mares, born in or before* 1931, *not having a foal at foot. A Mare* 6 *years old or over must have produced a live foal in* 1934 *or* 1935.

400 I. £15.—TOM JONES EVANS, Dinchope Farm, Craven Arms, for 8821 **Vean Brandy Snap**, chestnut, born in 1930, bred by Misses Calmady-Hamlyn & R. Dawson, Pearroc Vean, Buckfast; *s.* Craven Master Shot 1417, *d.* 8820 Dory *by* Llwyn Temptation 1263.
402 II. £10.—THE HON. MRS. DEVEREUX, Tregoyd, Three Cocks, Breconshire, for 6582 **Grove Peep O'Day**, white, born in 1919 [colt foal born May 19, 1935, *by* Grove Sprightly], bred by Mrs. H. D. Greene, Grove, Craven Arms; *s.* Bleddfa Shooting Star 73, *d.* 3017 Grove Twilight *by* Grove Ballistite 151.
401 III. £5.—THE HON. JEAN CAMPBELL, Hunthill, Jedburgh, for **Voelas Wild Rose** 8701, grey, born in 1927 [colt foal born May 12, 1934, *by* Majid], bred by R. A. C. Pugh, Voelas, Glandyfi, Cards.; *s.* Llwyn Brilliant 1342, *d.* Gyrn Red Rose 8261 *by* Criban Satan 112.

Shetland Ponies.

Class 68.—*Shetland Pony Stallions, born in or before* 1932.

406 I. £15 & Champion.[1]—WILLIAM MUNGALL, Transy, Dunfermline, Fife, for **Sonyad of Transy** 1105, black, born in 1921; *s.* Seaweed 333, *d.* 2657 Sonya of Transy *by* Glencairn 314.
405 II. £10.—W. GILCHRIST MACBETH, Dunira, Comrie, Perthshire, for **Rebel of Earlshall** Vol. 39, p. 23), black, born in 1931, bred by R. W. R. Mackenzie, Carpow, Newburgh; *s.* Emillius of Earlshall 1121, *d.* 3733 Ruby of Earslhall *by* Helmet of Earlshall 408.
403 III. £5.—W. GILCHRIST MACBETH, for **Dollar Boy** 1242, black, born in 1926, bred by F. N. M. Gourlay, Thornhill, Newburgh; *s.* Bravo of Earlshall 1115, *d.* 2708 Delilah *by* Dvorak 375.
408 R.N.—MISS P. L. STRAKER, Stagshaw, Corbridge, for **Nomad of Balmuir**.

Class 69.—*Shetland Pony Mares, born in or before* 1931, *not having a foal at foot. A Mare* 6 *years old or over must have produced a live foal in* 1934 *or* 1935.

413 I. £15 & R.N. for Champion.[1]—WILLIAM MUNGALL, Transy, Dunfermline, for 4611 **Thistley of Transy**, black, born in 1927 [filly foal born June 1, 1934, *by* Pole Star 884]; *s.* Dunsmuir 1155, *d.* 3949 Thistledown of Transy *by* Seaweed 333.

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[1] Champion Silver Medal given by the Shetland Pony Stud Book Society for the best Shetland Pony.

410 II. £10.—W. GILCHRIST MACBETH, Dunira, Comrie, Perthshire, for Elderflower 2nd of Earlshall 4604, black, born in 1928 [colt foal born May 16, 1934, *by* Dollar Boy 1242], bred by R. W. R. Mackenzie, Carpow, Newburgh; *s.* Helmet of Earlshall 408, *d.* 4295 Eliza of Earlshall *by* Gluss Norseman 759.

412 III. £5.—WILLIAM MUNGALL, for Stelmone of Transy (Vol. 39, p. 27). black, born in 1931; *s.* Sonyad of Transy 1105, *d.* 4450 Stelsa of Transy *by* Pole Star 884.

406, 412, 413 Special.[1]—WILLIAM MUNGALL, for Sonyad of Transy, Stelmone of Transy and Thistley of Transy.

Riding Classes.

HUNTERS.

Class 75.—*Hunter Mares or Geldings, born in* 1931.

502 I. £15.—J. V. RANK, Ouborough, Godstone, Surrey, for Wonder Bar, brown gelding born in 1931.

501 II. £10.—RAMSHAW & HUDDLESTONE, Kirkleatham Dairies, Redcar, for Acklam Ginger, chestnut gelding, born in 1931.

494 III. £5.—GEOFF KENYON, Armscote, Stratford-on-Avon, for Killaloe, bay gelding, born 1931.

507 IV. £3.—MR. AND MRS. T. R. V. RENTON, Paddock House, Starbeck, Yorks., for Rathclare, chestnut gelding, born in 1931.

509 R.N.—MR. AND MRS. T. R. V. RENTON, for Roebaro.

Class 76.—*Hunter Mares or Geldings (Novice), born in or before* 1931, *up to from* 12 *to* 14 *stones.*

514 I. £15.—JOHN DRAGE, Chapel Brampton, Northampton, for Gold, chestnut gelding, born in 1930.

498 II. £10.—LADY MURIEL LIDDELL-GRAINGER, Ayton Castle, Berwickshire, for Mons Meg, bay mare, born in 1930.

518 III. £5.—MISS MARGARET PEAT, Wycliffe Hall, Barnard Castle, for Ramaquin, bay gelding, born in 1929.

512 IV. £3.—J. J. SUMMERBELL, 8, Gosforth Villas, Gosforth, for Wonder Bar, chestnut gelding, born in 1930.

501 R.N.—RAMSHAW & HUDDLESTONE, for Acklam Ginger. (See Class 75).

Class 77.—*Hunter Mares or Geldings (Novice), born in or before* 1931, *up to more than* 14 *stones.*

530 I. £15.—JOHN STUBBS, Hessle Farm, Wragby, Wakefield, for Hallmark, brown gelding, born in 1930.

527 II. £10.—D. G. GREIG, Eccles, Greenlaw, Berwickshire, for Barney, brown gelding, born in 1930.

515 III. £5.—JOHN DRAGE, Chapel Brampton. Northampton, for Jack, bay gelding, born in 1930.

529 IV. £3.—JAMES J. PATERSON, Terrona, Langholm, for Jorrocks, black gelding, born in 1930.

499 R.N.—LADY MURIEL LIDDELL-GRAINGER, Ayton Castle, Berwickshire, for Macmerry.

Class 78.—*Hunter Mares or Geldings, born in or before* 1930, *up to not more than* 14 *stones, suitable to carry a Lady, and to be ridden by a Lady, side-saddle.*

504 I. £15 & R.N. for Champion.[2]—J. V. RANK, Ouborough, Godstone, Surrey, for Waterloo, bay gelding, born in 1927.

537 II. £10.—BERNARD A. SELBY, The Garden Cottage, The Goffs, Eastbourne, for Mortimer, brown gelding, born in 1928.

487 III. £5.—J. R. HINDLEY, Moorlands, Blacko, Nelson, Lancs., for Bradbury, bay gelding, born in 1930.

533 IV. £3.—MISS BETTY B. BIRD, The Lynches, Albert Road, Malvern, for Blenheim 2nd, chestnut gelding, born in 1929.

532 R.N.—THOS. & HY. WARD, Pinchinthorpe, Guisborough, for Perforce, H.C.—534.

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[1] Special Prize of £10 given through the Shetland Pony Stud Book Society for the best Group of one Stallion and two Mares.

[2] Perpetual Silver-Gilt Challenge Cup given by ladies and gentlemen interested in Hunters for the best Hunter Mare or Gelding.

Class 79.—*Hunter Mares or Geldings, born in or before* 1931, *up to from* 12 *to* 13.7 *stones.*

504 I. £20 & R.N. for Champion.[1]—J. V. RANK, for **Waterloo.** (See Class 78).
487 II. £15.—J. R. HINDLEY, for **Bradbury.** (See Class 78).
514 III. £10.—JOHN DRAGE, for **Gold.** (See Class 76).
537 IV. £5.—BERNARD A. SELBY, for **Mortimer.** (See Class 78).
533 V. £3.—MISS BETTY B. BIRD, for **Blenheim 2nd.** (See Class 78).
498 R.N.—LADY MURIEL LIDDELL-GRAINGER, for **Mons Meg.**

Class 80.—*Hunter Mares or Geldings, born in or before* 1931, *up to more than* 13.7 *stones, and not more than* 15 *stones.*

530 I. £20.—JOHN STUBBS, for **Hallmark.** (See Class 77).
532 II. £15.—THOS. & HY. WARD, Pinchinthorpe, Guisborough, for **Perforce,** bay gelding, born in 1929.
515 III. £10.—JOHN DRAGE, for **Jack.** (See Class 77).
512 IV. £5.—J. J. SUMMERBELL, for **Wonder Bar.** (See Class 76).
509 V. £3.—MR. AND MRS. T. R. V. RENTON, Paddock House, Starbeck, Yorks., for **Rocbaro,** chestnut gelding, born in 1931.
516 R.N.—MAJOR C. B. HORNBY, Anick Cottage, Hexham, for **Simon.**

Class 81.—*Hunter Mares or Geldings, born in or before* 1931, *up to more than* 15 *stones.*

495 I. £20 & Champion.[1]—GEOFF KENYON, Armscote, Stratford-on-Avon, for **James Pigg,** bay gelding, born in 1927.
540 II. £15.—BERNARD A. SELBY, The Garden Cottage, The Goffs, Eastbourne, for **Marlborough,** bay gelding, born in 1928.
527 III. £10.—D. G. GREIG, for **Barney.** (See Class 77).
529 IV. £5.—JAMES J. PATERSON, for **Jorrocks.** (See Class 77).
Specials.[2]—I. £10, J. J. SUMMERBELL; II. £5, MAJOR C. B. HORNBY; III. £3 and IV. £1, divided between LT.-COL. THE HON. H. E. JOICEY and T. RIDLEY.

CHILDREN'S PONIES.

Class 82.—*Pony Mares or Geldings, not exceeding* 13 *hands, to be ridden by a child born in or after* 1925.

546 I. £10.—ANDREW MASSARELLA, Belmont, Bentley, Doncaster, for **Steel Dust,** grey gelding, born in 1927.
543 II. £5.—AYTON CASTLE PONY STUD, Berwickshire, for **Lavender,** grey mare, born in 1930.
544 III. £3.—THE HON. JEAN CAMPBELL, for **Voelas Wild Rose.** (See Class 67).
542 R.N.—AYTON CASTLE PONY STUD, for **Bluebell.**

Class 83.—*Pony Mares or Geldings, over* 13 *and not exceeding* 14 *hands, to be ridden by a child born in or after* 1922.

550 I. £10.—WILLIAM BENSON, Harrowby Fields, Grantham, for **Flash,** chestnut mare, born in 1928.
554 II. £5.—J. COLIN SINCLAIR, Mardon Grange, Cornhill-on-Tweed, for **Fleetwing,** brown mare, born in 1931.
549 III. £3.—AYTON CASTLE PONY STUD, Berwickshire, for **White Spot,** black mare, born in 1931.
551 R.N.—C. T. CARSLEY, Walk Mill, Wall-on-Tyne, for **Nancy.**

Class 84.—*Pony Mares or Geldings, over* 14 *and not exceeding* 15 *hands, to be ridden by a child born in or after* 1919.

564 I. £10.—MRS. LAUNCELOT E. SMITH, Piper Close, Corbridge-on-Tyne, for **Primula,** grey mare, born in 1928.
559 II. £5.—ALBERT H. HINDLEY, Stanley Lodge, Bay Horse, Lancaster, for **Beam,** bay mare, born in 1927.
556 III. £3.—WILLIAM BENSON, Harrowby Fields, Grantham, for **Johnny Walker,** brown gelding, born in 1930.
558 R.N.—MISS BARBARA T. CLIFF, The Grove, Scawby, Brigg, for **Joseph.**
H.C.—560.

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[1] Perpetual Silver-Gilt Challenge Cup given by ladies and gentlemen interested in Hunters for the best Hunted Mare or Gelding.

[2] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the Hunter Riding Classes.

Hacks.

608 I. £7.—CAPT. J. E. HANCE, Southbury House, Malvern, for **Ecstasy**, brown gelding, born in 1926.
613 II. £5.—LAUNCELOT E. SMITH, Piper Close, Corbridge-on-Tyne, for **Cark White Pearl**, grey mare, born in 1929.
614 III. £3.—LAUNCELOT E. SMITH, for **Flashlight**, chestnut mare, born in 1928.
616 R.N.—MRS. FLEURY TEULON, Hazel Bush, Stockton-on-Forest, Yorks., for **Jonquil**.
H.C.—561.

Driving Classes.

SINGLE HARNESS.

Class 85.—*Stallions, Mares or Geldings (Novice), not exceeding* 14 *hands.*

584 I. £15.—WILLIAM S. MILLER, Balmanno Castle, Bridge of Earn, for **Beau Sabreur**, bay gelding, born in 1929.
570 II. £10.—MRS. G. BOWER, Priory Farm, Fressingfield, Suffolk, for **Anyx Zenophon**, bay stallion, born in 1931.
576 III. £5.—MRS. EDGAR HENRIQUES, Fernholm, Hesketh Park, Southport, for **Fleetwood Petal**, bay mare, born in 1931.
588 R.N.—J. W. G. SMITH, Wensleydale Stud, Aysgarth, Yorks., for **Wensleydale Regal**,
C.—572.

Class 86.—*Stallions, Mares or Geldings (Novice), over* 14 *hands.*

594 I. £15.—NIGEL C. COLMAN, M.P., 49, Grosvenor Square, London, W., for **Nork Spotlight**, brown stallion, born in 1931.
577 II. £10.—MRS. EDGAR HENRIQUES, Fernholm, Hesketh Park, Southport, for **Fleetwood Nightingale**, chestnut mare, born in 1931.
591 III. £5.—WALTER BRIGGS, Linden Hall, Borwick, Carnforth, for **Salford City**, chestnut stallion, born in 1926.

Class 87.—*Stallions, Mares or Geldings, not exceeding* 13.2 *hands.*

595 I. £15.—NIGEL C. COLMAN, M.P., 49, Grosvenor Square, London, W., for **Nork Magnet**, bay gelding.
598 II. £10.—WALTER BRIGGS, Lindel Hall, Borwick, Carnforth, for **Barcroft Belle**, bay mare, born in 1927.
586 III. £5.—WILLIAM S. MILLER, Balmanno Castle, Bridge of Earn, for **Beau Regarde**, bay gelding, born in 1929.
573 R.N.—JOHN W. HEMINGWAY, Ingmanthorpe Hall, Wetherby, for **Glenavon Cupid**.

Class 88.—*Stallions, Mares or Geldings, over* 13.2 *and not exceeding* 14 *hands.*

607 I. £15.—FRANK C. MINOPRIO, Broadlands, Ascot, for **Mickey Mouse**, bay gelding, born in 1927.
599 II. £10.—PAUL HOFFMANN, 4, Cardigan Mansions, Richmond Hill, Surrey, for **Orford Caprice**, dark brown mare, born in 1926.
579 III. £5.—MRS. EDGAR HENRIQUES, Fernholm, Hesketh Park, Southport, for **Fleetwood Live Fuse**, brown gelding, born in 1926.

Class 89.—*Stallions, Mares or Geldings, over* 14 *and not exceeding* 15 *hands.*

580 I. £15.—MRS. EDGAR HENRIQUES, Fernholm, Hesketh Park, Southport, for **Fleetwood Nanette**, chestnut mare, born in 1925.
594 II. £10.—NIGEL C. COLMAN, M.P., for **Nork Spotlight**. (See Class 86).
589 III. £5.—J. W. G. SMITH, Wensleydale Stud, Aysgarth, Yorks., for **Wensleydale Madge**, bay mare, born in 1927.

Class 90.—*Stallions, Mares or Geldings, over* 15 *hands.*

581 I. £15.—MRS. EDGAR HENRIQUES, Fernholm, Hesketh Park, Southport, for **Fleetwood Viking**, brown stallion, born in 1929.
596 II. £10.—NIGEL C. COLMAN, M.P., 49, Grosvenor Square, London, W., for **Modern Maid**, bay mare.
575 III. £5.—JOHN W. HEMINGWAY, Ingmanthorpe Hall, Wetherby, for **Glenavon Tradition**, bay gelding, born in 1928.
571 R.N.—MRS. G. BOWER, Priory Farm, Fressingfield, Suffolk, for **Taormina**.

DOUBLE HARNESS.

Class 91.—*Pairs of Stallions, Mares or Geldings.*

584 & 586 I. £15.—WILLIAM S. MILLER, for **Beau Sabreur** (See Class 85) and **Beau Regarde** (See Class 87).
604 & 607 II. £10.—FRANK C. MINOPRIO, for **King of the Lawn**, bay gelding, born in 1929, and **Mickey Mouse**. (See Class 88).
578 & 583 III. £5.—MRS. EDGAR HENRIQUES, for **Fleetwood Zephyr**, bay mare, born in 1929, and **Fleetwood Golden Rain**, bay mare, born in 1929.

TANDEMS.

Class 92.—*Stallions, Mares or Geldings, not exceeding* 14 *hands.*

604 & 607 I. £15.—FRANK C. MINOPRIO, for King of the Lawn and Mickey Mouse. (See Class 91).

578 & 583 II. £10.—MRS. EDGAR HENRIQUES, for Fleetwood Zephyr and Fleetwood Golden Rain. (See Class 91).

CATTLE.

Unless otherwise stated the Prizes in each Class for Cattle are as follows: First Prize, £15; Second Prize, £10; Third Prize, £5; Fourth Prize, £4; Fifth Prize, £3.

Shorthorns.

Class 94.—*Shorthorn Bulls, born in or before* 1932.

702 I., Champion,[1] Champion[2] & R.N. for Champion.[3]—A. J. MARSHALL, Bridgebank, Stranraer, for Cruggleton Beverley 25691, dark roan, born Aug. 28, 1932; *s.* Cruggleton Colonel 236411, *d.* 120952 Brenda Blythesome *by* Balcairn Celt 220695.

700 II.—J. BAIRD & CO. (FALKIRK), LTD., Bantaskin, Falkirk, for Crieffvechter Desperado 249960, white, born May 30, 1931, bred by W. D. Dron, Crieffvechter, Crieff; *s.* Aldie Air Raid 227618, *d.* 2385 Jessica *by* Gloaming Star 136732.

706 III.—MAJOR H. C. ROBINSON, Magheramorne, Co. Antrim, for Cruggleton Premium 256683, roan, born June 6, 1932, bred by A. J. Marshall, Bridgebank, Stranraer; *s.* Balcairn Colonel 227865, *d.* 59825 Lutwyche Pauline *by* King William 173110.

704 R.N.—JAMES V. RANK, Ouborough, Godstone, Surrey, for Corston Notable.
H.C.—701.

702, 719, 743 Special I.[4]—A. J. MARSHALL, for Cruggleton Beverley, Cruggleton Prosperitas and Cruggleton Alien.

753, 756, 781 Special II.[4]—MISS A. S. BROCKLEBANK, O.B.E., for Wing Broadhooks 2nd, Wing Princess Royal 4th and Wing Broadhooks 3rd.

714, 771, 786, R.N. for Specials.[4]—CHARLES A. LINZEE-GORDON, for Cluny Goldfinder, Cluny Waterloo Princess 2nd and Cluny Primrose 18th.

Class 95.—*Shorthorn Bulls, born on or between January* 1 *and March* 31, 1933.[5]

709 I.—THE EARL OF CRAWFORD AND BALCARRES, K.T., Balcarres House, Colinsburgh, Fife, for Crieffvechter Finance 262934, dark roan, born March 31, bred by W. D. Dron, Crieffvechter, Crieff; *s.* Royal Defiance 240020, *d.* 127806 Village Maiden 3rd *by* Cambus Hector 228743.

707 II.—JOSEPH BARNES, Barugh Syke, Wigton, for Stonelands Ransom 266989, dark roan, born March 25, bred by Norman N. Lee (Stonelands) Ltd., Arncliffe, Skipton-in-Craven; *s.* Glastullich Banker 250976, *d.* 109771 Rosetta 2nd *by* Collynie Red Eagle 214703.

711 III.—J. HARRIS, Brackenburgh Tower, Penrith, for Duke of Cumberland 149th 263439, dark roan, born Feb. 23; *s.* Duke of Cumberland 139th 243745, *d.* 97463 Duchess 190th *by* Oxford Duke of Calthwaite 100th 201491.

Class 96.—*Shorthorn Bulls, born on or between April* 1 *and December* 31, 1933.

714 I.—CHARLES A. LINZEE-GORDON, Cluny Castle, Sauchen, Aberdeenshire, for Cluny Goldfinder 262721, red, born Nov. 18; *s.* Glastullich Sirdar 237378, *d.* 127956 Golden Rose *by* Cluny Lavender Victor 222138.

712 II.—ARTHUR GREEN, Highfield, Denton, Ilkley, for Denton Hopeful 263265, red, born Sept. 29; *s.* Schwas Domain 240172, *d.* 118600 Denton Crystal *by* Staff Officer 226629.

Class 97.—*Shorthorn Bulls, born on or between January* 1 *and March* 31, 1934.[5]

721 I. & R.N. for Champion.[1]—DUNCAN M. STEWART, Millhills, Crieff, Perthshire, for Anticur Wonder 268015, roan, born Feb. 6, bred by John Wallace, Anticur, Dunboy, Northern Ireland; *s.* Eclipse 222873, *d.* 92319 Anticur Dairymaid *by* Solomon 202902.

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[1] Champion Prize of £20 given by the Shorthorn Society for the best Bull. A Silver Medal was given by the Shorthorn Society to the Breeder of the Champion Bull.

[2] Silver Challenge Cup given by the Argentine Shorthorn Breeders' Association for the best Bull, bred by Exhibitor.

[3] The "Brothers Colling" Memorial Perpetual Challenge Cup presented through the Durham Agricultural Committee for the best Shorthorn.

[4] Special Prizes of £15 First Prize and £10 Second Prize given by the Shorthorn Society for the best groups of three Shorthorns bred by Exhibitor.

[5] Prizes given by the Shorthorn Society.

720 II.—JAMES V. RANK, Ouborough, Godstone, Surrey, for **Calrossie Air Control 268880**, dark roan, born March 11, bred by Capt. J. MacGillivray, Calrossie, Nigg; *s.* Calrossie Control 255913, *d.* 120610 Calrossie Clipper 2nd *by* Naemoor Jasper 217761.
719 III.—A. J. MARSHALL, Bridgebank, Stranraer, for **Cruggleton Prosperitas 269664**, red, born Feb. 23; *s.* Cruggleton Essander 250076, *d.* 99662 Princess Jessamine *by* Balcairn Baronet 153566.
716 R.N.—SIR BERNARD GREENWELL, BART., Marden Park, Woldingham, Surrey, for **Marden Snowstorm.**
H.C.—715.

Class 98.—*Shorthorn Bulls, born on or between April* 1 *and June* 30, 1934.

723 I.—J. BAIRD & CO. (FALKIRK), LTD., Bantaskin, Falkirk, for **Killineer Peter 271394**, white, born April 2, bred by J. F. Barr, Killineer, Drogheda; *s.* Millhills Number One 252382, *d.* 83474 Balnakyle Symmetry 6th *by* Balnakyle Rothes Regent 204816.
731 II.—JAMES V. RANK, Ouborough, Godstone, Surrey, for **Bapton Banner Bearer 268265**, red roan, born May 11, bred by Bapton Shorthorn Co., Ltd., Bapton Manor, Warminster; *s.* Bapton Ringleader 255310, *d.* 145441 Bapton Kilbleau Beauty 13th *by* Calrossie Ringleader 235690.
732 III.—JAMES V. RANK, for **Bapton Royal Leader 268277**, dark roan, born April 24, bred by Bapton Shorthorn Co., Ltd., Bapton Manor, Warminster; *s.* Calrossie Ringleader 235690, *d.* 83797 Bapton Princess Royal 3rd *by* Cluny Prince Regent 179639.
726 R.N.—WILLIAM BARNES, The Street, Wigton, for **Scotston Captain.**

Class 99.—*Shorthorn Bulls, born on or between July* 1 *and December* 31, 1934.[1]

743 I. & R.N. for Champion.[2]—A. J. MARSHALL, Bridgebank, Stranraer, for **Cruggleton Alien 269545**, red and little white, born July 12; *s.* Cruggleton Essander 250076, *d.* 120962 Cruggleton Averne *by* Lutwyche Challenger 191796.
736 II.—HIS MAJESTY THE KING, The Royal Farms, Windsor, for **Windsor Guardsman 274201**, dark roan, born Sept. 28; *s.* Millhills Nigel 252378, *d.* 114952 Windsor Princess Royal *by* Windsor Actor 227423.
745 III.—DUNCAN M. STEWART, Millhills, Crieff, Perthshire, for **Millhills Quarterstaff 272006**, dark roan, born Aug. 23; *s.* Millhills Opal 258806, *d.* 102328 Millhills Augusta 13th *by* Naemoor Ironclad 209846.
740 R.N.—MRS. W. R. CALVERT, Wetmore, Onibury, Shropshire, for **Wetmore Aristocrat.**
H.C.—742. C.—738.

Class 100.—*Shorthorn Cows, in-milk, born in or before* 1931.

747 I. & R.N. for Champion.[3]—CHARLES A. LINZEE-GORDON, Cluny Castle, Sauchen, Aberdeenshire, for **126703 Cluny Augusta 29th**, dark roan, born Jan. 21, 1931, calved Oct. 4, 1934, bred by Lady Cathcart, Cluny Castle, Aberdeenshire; *s.* Bruiach Ian, 214009, *d.* 71720 Cluny Augusta 21st *by* Brawith Chieftain 187661.
750 II.—W. MCNAIR SNADDEN, Coldoch, Blair Drummond, Stirling, for **130764 Calrossie Roan Flora**, roan, born Jan. 27, 1930, calved Feb. 28, 1935, bred by Capt. John McGillivray, Calrossie, Nigg; *s.* Naemoor Gaffer 192364, *d.* 27018 Calrossie Twin Flora *by* Sentinel Star 159279.
746 III.—G. MEREDYTH HOPE, Basildon Home Farm, Pangbourne, for **135352 Yedingham Mina 12th**, dark roan, born April 1, 1931, calved March 28, 1935, bred by F. Allison, Lilac Farm, Yedingham, Yorks; *s.* Yedingham Warrior 241301, *d.* 70106 Yedingham Mina 3rd *by* Equinox 189562.
752 R.N.—W. MCNAIR SNADDEN, for **Coldoch Rosewood.**
H.C.—749.

Class 101.—*Shorthorn Heifers, in-milk, born in* 1932.

754 I.—JAMES V. RANK, Ouborough, Godstone, Surrey, for **145439 Bapton Crocus 24th**, dark roan, born Nov. 23, calved March 28, 1935, bred by the Bapton Shorthorn Co., Ltd., Bapton Manor, Warminster; *s.* Calrossie Ringleader 235690, *d.* 125565 Bapton Crocus 16th *by* Collynie Viceroy 188660.
755 II.—DUNCAN M. STEWART, Millhills, Crieff, Perthshire, for **153187 Cherrywood 4th**, white, born April 5, calved Nov. 25, 1934; *s.* Royal Defiance 240020, *d.* 102326 Cherrywood 3rd *by* Naemoor Ironclad 209846.
753 III.—MISS A. S. BROCKLEBANK, O.B.E., Wing Grange, Oakham, for **146089 Wing Broadhooks 2nd**, dark roan, born Jan. 26, calved Oct. 5, 1934; *s.* Wing Royal Sportsman 248056, *d.* 91607 Haselor Broadhooks 4th *by* Rothiebrisbane Bulwark 202379.

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[1] Prizes given by the Shorthorn Society.
[2] Silver Challenge Cup given by the Argentine Shorthorn Breeders' Association for the best Bull, bred by Exhibitor.
[3] Champion Prize of £20 given by the Shorthorn Society for the best Cow or Heifer. A Silver Medal was given by the Shorthorn Society to the Breeder of the Champion Cow or Heifer.

Class 102.—*Shorthorn Heifers, born in* 1933.

757 I.—MRS. M. CHICHESTER-CLARK, Moyola Park, Castledawson, Co. Derry, for 156307 **Castledawson White Lupin**, white, born May 9; *s.* Anticur President 204492, *d.* 88479 Augusta Lupin *by* Bridgebank Annum 187694.
765. II.—DUNCAN M. STEWART, Millhills, Crieff, Perthshire, for 157426 **Uppermill Paula**, roan, born Feb. 27, bred by James Durno, Uppermill, Aberdeenshire; *s.* Glastullich Watchman 237380, *d.* 44932 Climsland Paula *by* Cluny Nonpareil Choice, 170400.
756 III.—MISS A. S. BROCKLEBANK, O.B.E., Wing Grange, Oakham, for 155786 **Wing Princess Royal 4th**, dark roan, born Oct. 9; *s.* Collynie Red Leader 249856, *d.* 83040 Wing Princess Royal *by* Balcairn Golden Monarch 186905.
758 R.N.—THE EARL OF CRAWFORD AND BALCARRES, K.T., Balcarres House, Colinsburgh, Fife, for **Balcarres Jeanne.**
H.C.—766. C.—761.

Class 103.—*Shorthorn Heifers, born on or between January* 1 *and March* 31, 1934.

772 I., Champion[1] and Champion.[2]—JAMES V. RANK, Ouborough, Godstone, Surrey, for 164839 **Bapton Augusta 11th**, roan, born Jan. 4, bred by the Bapton Shorthorn Co., Ltd., Bapton Manor, Warminster; *s.* Calrossie Ringleader 235690, *d.* 125562 Bapton Augusta 6th *by* Bapton Merry Lad 220862.
768 II.—SIR BERNARD GREENWELL, BART., Marden Park, Woldingham, Surrey, for **Marden Rosebud 15th**, roan, born Feb. 4; *s.* Marden Eagle 252258, *d.* 45903 Red Rosebud *by* Balcairn Warden 168707.
771 III.—CHARLES A. LINZEE-GORDON, Cluny Castle, Sauchen, Aberdeenshire, for **Cluny Waterloo Princess 2nd**, roan, born Feb. 26; *s.* Glastullich Sirdar 237378, *d.* 122824 Lynegar Waterloo Princess 19th *by* Cluny Lord Eric 229135.
776 R.N.—DUNCAN M. STEWART, Millhills, Crieff, Perthshire, for **Millhills Missie 21st.**
H.C.—770. C.—767.

Class 104.—*Shorthorn Heifers, born on or between April* 1 *and December* 31, 1934.

781 I.—MISS A. S. BROCKLEBANK, O.B.E., Wing Grange, Oakham, for 165438 **Wing Broadhooks 3rd**, dark roan, born Oct. 5; *s.* Collynie Red Leader 249856, *d.* 146089 Wing Broadhooks 2nd *by* Wing Royal Sportsman 248056.
788 II.—JAMES V. RANK, Ouborough, Godstone, Surrey, for 164841 **Bapton Broadhooks 5th**, red, born Aug. 24, bred by the Bapton Shorthorn Co., Ltd., Bapton Manor, Warminster; *s.* Bapton Royal Robin 255311, *d.* 22145 Cluny Broadhooks *by* Cluny Prince Royal 154876.
786 III.—CHARLES A. LINZEE-GORDON, Cluny Castle, Sauchen, Aberdeenshire, for **Cluny Primrose 18th**, red, born April 8; *s.* Glastullich Sirdar 237378, *d.* 105897 Cluny Primrose 13th *by* Red Robin 210743.
790 IV.—DUNCAN M. STEWART, Millhills, Crieff, Perthshire, for **Scottish Buttercup 28th**, white, born April 8; *s.* Royal Defiance 240020, *d.* 67943 Scottish Buttercup 14th *by* Cupbearer of Collynie 114960.
782 R.N.—MRS. M. CHICHESTER-CLARK, Moyola Park, Castledawson, Co. Derry, for **Castledawson Augusta Purity.**
H.C.—789. C.—785.
Special I. £8.[3]—THE DUKE OF NORTHUMBERLAND, Park Farm, Alnwick.

Herefords.

Class 105.—*Hereford Bulls, born on or before August* 31, 1932.

[No Entries.]

Class 106.—*Hereford Bulls, born on or between September* 1, 1932, *and August* 31, 1933.

793 I., Champion[4] and Champion.[5]—EDWARD WEBB & SONS (STOURBRIDGE) LTD., Astwood Farm, Stoke Works, Bromsgrove, for **Astwood Conveyer** 55495, born Sept. 29, 1932; *s.* Free Town Counsellor 50495, *d.* Gobion Oyster Girl *by* Gobion Resolute 46010.
792 II. & R.N. for Champion.[1]—MAJOR J. N. RITCHIE, Tern, Wellington, Shropshire, for **Tern Gauntlet** 56572, born April 18, 1933; *s.* Lydham Merrylute 50727, *d.* Tern Coral *by* Burton Showman 46873.

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[1] The "Brothers Colling" Memorial Perpetual Challenge Cup presented through the Durham Agricultural Committee for the best Shorthorn.

[2] Champion Prize of £20 given by the Shorthorn Society for the best Cow or Heifer. A Silver Medal was given by the Shorthorn Society to the Breeder of the Champion Cow or Heifer.

[3] Special Prize given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the Shorthorn Classes.

[4] Champion Prize of £10 10s. given by the Hereford Herd Book Society for the best Senior Bull.

[5] Perpetual Silver Challenge Trophy given through the Hereford Herd Book Society for the best Bull.

Class 107.—*Hereford Bulls, born on or between September* 1 *and November* 30, 1933.[1]

800 I., R.N. for Champion[2] & Champion.[3]—R. S. DE Q. QUINCEY, The Vern, Bodenham, Hereford, for **Tarrington Dacoit** 57910, born Sept. 8, bred by H. R. Griffiths, Little Tarrington, Herefordshire; *s.* Tarrington Optimist 49837, *d.* Dixie *by* Orion of Pitsford 45197.
797 II.—H. R. JENKINS, The Porch, Westhide, Hereford, for **Westhide Dragon**, born Oct. 10; *s.* Free Town Cameronian 53214, *d.* Eyton Countess 31st (Vol. 60, p. 561) *by* Eyton Robin 47033.
801 III.—R. S. DE Q. QUINCEY, for **Vern Leonardo** 57981, born Oct. 12; *s.* Eyton Baron 54500, *d.* Gaines Curly 2nd *by* Rochford Batman 41575.
794 R.N.—HIS MAJESTY THE KING, The Royal Farms, Windsor, for **The Sultan.**
H.C.—798.

Class 108.—*Hereford Bulls, born on or between December* 1, 1933, *and February* 28, 1934.

802 I. & R.N. for Champion.[3]—H. R. JENKINS, The Porch, Westhide, Hereford, for **Tarrington Star Turn**, 57918, born Feb. 19, 1934, bred by H. R. Griffiths, Little Tarrington, Herefordshire; *s.* Eyton Batman 57179, *d.* Splendour *by* Free Town Director 49237.
805 II.—E. CRAIG TANNER, Eyton-on-Severn, Wroxeter, Shropshire, for **Westhide Dandy**, born Dec. 13, 1933, bred by H. R. Jenkins, The Porch, Westhide, Hereford; *s.* Free Town Cameronian 53214, *d.* Westhide Dowager (Vol. 63, p. 341) *by* Pertonlute 50945.
803 III.—JOHN PARR, Burton, Ross, Herefordshire, for **Burton Gladiator**, born Dec. 1, 1933; *s.* Burton Lux 52961, *d.* Silk 2nd (Vol. 56, p. 473) *by* Bounds Ironclad 36089.
804 R.N.—R. S. DE Q. QUINCEY, The Vern, Bodenham, Hereford, for **Vern Locksmith.**

Class 109.—*Hereford Bulls, born on or after March* 1, 1934.

811 I.—JAMES MEDLICOTT, Bodenham Court, Hereford, for **Bodenham Warner**, born March 1, 1934, bred by R. Medlicott, Hampton Park House, Stoke Prior, Leominster; *s.* Tarrington Warden 55279, *d.* Prune 3rd (Vol. 62, p. 440) *by* Rose Haughty 49750.
809 II.—H. R. GRIFFITHS & SON, Little Tarrington, Herefordshire, for **Tarrington Duplex** 57911, born April 17, 1934, bred by H. R. Griffiths; *s.* Tarrington Optimist 49837, *d.* Dewdrop *by* Gaines Albion 45982.
807 III.—HIS MAJESTY THE KING, The Royal Farms, Windsor, for **Windsor Paymaster** 58070, born April 12, 1934; *s.* Windsor Bellman 55398, *d.* Peggy *by* Lulsley Statesman 37327.
815 R.N.—EDWARD WEBB & SONS (STOURBRIDGE), LTD., Astwood Farm, Stoke Works, Bromsgrove, for **Astwood Prospector.**
H.C.—810, 812.

Class 110.—*Hereford Cows or Heifers, in-milk, born on or before August* 31. 1932.

816 I. & Champion.[4]—H. R. GRIFFITHS & SON, Little Tarrington, Herefordshire, for **Britannia** (Vol. 62, p. 328), born March 6, 1931, calved Nov. 12, 1934, bred by H. R. Griffiths; *s.* Tarrington Optimist 49837, *d.* Bluebell *by* Tarrington Marquis 45453.

Class 111.—*Hereford Heifers, born on or between September* 1, 1932, *and August* 31, 1933.

818 I.—H. R. GRIFFITHS & SON, Little Tarrington, Herefordshire, for **Morania** (Vol. 64, p. 293), born Sept. 22, 1932, bred by H. R. Griffiths; *s.* Tarrington Sports Model 53924, *d.* Madrigal *by* Noke Ensign 45189.
817 II.—HIS MAJESTY THE KING, The Royal Farms, Windsor, for **Windsor Susie**, born May 25, 1933; *s.* Windsor Aristocrat 52679, *d.* Windsor Sue (Vol. 54, p. 155) *by* Lulsley Statesman 37327.

Class 112.—*Hereford Heifers, born on or between September* 1 *and November* 30, 1933.[1]

819 I. & R.N. for Champion.[4]—E. CRAIG TANNER, Eyton-on-Severn, Wroxeter, Shropshire, for **Eyton Princess**, born Sept. 18; *s.* Eyton Baronet 54501, *d.* Princess May (Vol. 58, p. 196) *by* Rosestock 47538.

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[1] Prizes given by the Hereford Herd Book Society.
[2] Perpetual Silver Challenge Trophy given through the Hereford Herd Book Society for the best Bull.
[3] Champion Prize of £10 10*s*. given by the Hereford Herd Book Society for the best Junior Bull.
[4] Champion Prize of £10 10*s*. given by the Hereford Herd Book Society for the best Cow or Heifer.

Class 113.—*Hereford Heifers, born on or after December* 1, 1933.

820 I.—CAPT. E. H. ROUSE BOUGHTON, Downton Hall, Ludlow, for **Downton Hall Pansy**, born Jan. 20, 1934; *s.* Saracen 52427, *d.* Icicle (Vol. 57, p. 173) *by* Percentage 37655.

Devons.

Class 114.—*Devon Bulls, born in or before* 1933.

823 I. & Champion.[1]—GORDON C. SKINNER, Pound, Bishop's Lydeard, Somerset, for **Zealot 15961**, born Nov. 27, 1928, bred by S. Fisher, Woodgate, Culmstock, Devon; *s.* Farringdon Grandee 13577, *d.* Herne Beauty 2nd *by* Highfield War Baby 9842.

821 II. & R.N. for Champion.[1]—HIS MAJESTY THE KING, The Royal Farms, Windsor, for **Bartridge Gentleman 2nd 16350**, born Jan. 5, 1933, bred by J. C. H. Thomas, Brightley Barton, Umberleigh; *s.* Landkey Star 15778, *d.* Clampit Gentle 41045 *by* Highfield Gem 8919.

822 III.—GEORGE BRENDON, Bude, Cornwall, for **Hawthorn Grand Duke 14897**, born Nov. 15, 1928, bred by Robert Maunder, Hawthorn, Bathealton, Somerset; *s.* Coombeshead Grand Duke 13540, *d.* Lovely 4th 38322 *by* Alien 10831.

825 R.N.—P. M. WILLIAMS, Stowford, Chittlehampton, Devon, for **Stowey Fascist.**

Class 115.—*Devon Bulls, born in* 1934.

831 I.—ABRAHAM TRIBLE & SONS, Halsdon, Holsworthy, Devon, for **Stoke Rubicon**, born Feb. 1, bred by G. C. Alexander, Winterbourne Stoke; *s.* Enmore Pegtop 15710, *d.* Stoke Rosa 89968 *by* Clampit Flier 12594.

826 II.—FRED BEADLE, Stowey Farm, Timberscombe, Somerset, for **Stowey Faction 17017**, born March 24; *s.* Carey Delegate 15640, *d.* Stowey Fashion 45684 *by* Charton Tip Top 2nd 13515.

830 III.—GORDON C. SKINNER, Pound, Bishop's Lydeard, Somerset, for **Field Master 16865**, born Jan. 24; *s.* Daisy's Pride 15272, *d.* Pound Fillpan 21st 45454 *by* Charton Tip Top 2nd 13515.

829 R.N.—FRED J. MORALEE, North Charlton, Chathill, for **Carey Rover.**

Class 116.—*Devon Cows or Heifers, in-milk, born in or before* 1932.

832 I. & Champion.[2]—CECIL BRENT, Clampit, Callington, Cornwall, for **Clampit Dainty 10th 41040**, born March 31, 1928, calved Jan. 18, 1935; *s.* Pound Romper 12413, *d.* Clampit Dainty 7th 37749 *by* Highfield Gem 8919.

833 II. & R.N. for Champion.[2]—CECIL BRENT, for **Clampit Lady Launceston 6th 37754**, born April 2, 1925, calved Dec. 18, 1934; *s.* Pound Romper 12413, *d.* Clampit Lady Launceston 5th 34701 *by* Highfield Gem 8919.

834 III.—ELAND CLATWORTHY, Cutsey, Trull, Taunton, for **Upcott Curly 47th 41931**, born Feb. 24, 1928, calved April 28, 1935, bred by F. J. Yendell, Grilstone House, South Molton, Devon; *s.* Pound Dazzle 11996, *d.* Upcott Curly 32nd 34600 *by* Nadrid Cæsar 2nd 8586.

Class 117.—*Devon Heifers, born in* 1933.

837 I.—W. G. BRENT, Warrens Park, Congdon Shop, Launceston, for **Warrens Park Dainty 45718**, born Jan. 31; *s.* Pigsdon Useful 14566, *d.* Warrens Park Cone 41055 *by* Combeshead Conqueror 13063.

Class 118.—*Devon Heifers, born in* 1934.

839 I.—HIS MAJESTY THE KING, The Royal Farms, Windsor, for **Windsor Melly**, born March 25; *s.* Warrens Park Timothy 16698, *d.* Warrens Park A.4 42991 *by* Stoke General 12877.

842 II.—ELAND CLATWORTHY, Cutsey, Trull, Taunton, for **Cutsey Charming 46575**, born Jan. 11; *s.* Enmore Lochinvar 15708, *d.* Upcott Curly 47th 41931 *by* Pound Dazzle 11996.

844 III.—A. M. WILLIAMS, Werrington Park, Launceston, for **Werrington Dainty 6th 47105**, born Feb. 21; *s.* Lee Thick 'Un 15784, *d.* Ham Mill Dainty 15th 39731 *by* Highfield Blue Blood 2nd 11509.

Sussex.

Class 119.—*Sussex Bulls, born in or before* 1933.

[No Entries.]

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[1] Champion Prize of £10 10*s.* given by the Devon Cattle Breeders' Society for the best Bull.

[2] Champion Prize of £10 10*s.* given by the Devon Cattle Breeders' Society for the best Cow or Heifer.

Class 120.—*Sussex Bulls, born in* 1934.

848 **I., Champion,[1] Champion[2] & Champion.[3]**—COL. J. R. WARREN, O.B.E., M.C., The Hyde, Handcross, Haywards Heath, for **Handcross Rover 10th**, born Jan. 20; *s.* Bolebroke Rover 1st 7411, *d.* Wickham Court Beauty 111th 25269 *by* Ripton Rover 4554.

847 **II., R.N. for Champion[1] & R.N. for Champion.[2]**—LORD LECONFIELD, Petworth House, Petworth, for **Petworth Loyal 5th**, born Jan. 22; *s.* Dillions Loyal 7555, *d.* Petworth Milkmaid 5th 26204 *by* Lock Toreador 2nd 5924.

846 **III.**—EDWARD HURTLEY, Crowborough Warren, Sussex, for **Crowborough Warren Marksman 26th**, born Jan. 25; *s.* Crowborough Warren Marksman 6th 7200, *d.* Crowborough Warren Belle 2nd 26158 *by* Dillions Honest 7050.

Class 121.—*Sussex Cows or Heifers, in-milk, born in or before* 1932.

849 **I. & R.N. for Champion.[4]**—BRIG.-GENERAL G. HOLDSWORTH, C.B., C.M.G., Glynde Place, Glynde, Sussex, for **Caburn Beauty 4th 24039**, born Jan. 25, 1927, calved Feb. 18, 1935; *s.* Bolebroke Lad 6th 6008, *d.* Caburn Gladeye 20747 *by* Wadden Luck 4891.

852 **II.**—COL. J. R. WARREN, O.B.E., M.C., The Hyde, Handcross, Haywards Heath, for **Wateringbury Farleigh 26455**, born April 17, 1932, calved Jan. 3, 1935, bred by Osborn Dan, Wateringbury Place, Wateringbury, Kent; *s.* King's Barn Sunduke 7378, *d.* Coombs Farleigh 2nd 24949 *by* Warehorne Golden Miller 6627.

850 **III.**—EDWARD HURTLEY, Crowborough Warren, Sussex, for **Crowborough Warren Poppy 3rd 26602**, born Jan. 9, 1932, calved Feb. 18, 1935; *s.* Crowborough Warren Marksman 6th 7200, *d.* Oakover Poppy 5th 21566 *by* Chevalier 2nd 3673.

Class 122.—*Sussex Heifers, born in* 1933.

853 **I., R.N. for Champion[2] & Champion.[4]**—BRIG.-GENERAL G. HOLDSWORTH, C.B., C.M.G., Glynde Place, Glynde Sussex, for **Caburn Darkey 18th 26978**, born March 5; *s.* Caburn Diploma 6370, *d.* Caburn Darkey 2nd 22721 *by* Hermitage King 5629.

854 **II.**—COL. J. R. WARREN, O.B.E., M.C., The Hyde, Handcross, Haywards Heath, for **Handcross Darkey 8th 27132**, born Jan. 10; *s.* Handcross Harlequin 7803, *d.* Handcross Darkey 3rd 25919 *by* Jacques Court G.2. 6708.

Class 123.—*Sussex Heifers, born in* 1934.

860 **I.**—COL. J. R. WARREN, O.B.E., M.C., The Hyde, Handcross, Haywards Heath, for **Handcross Knelle 3rd**, born May 17; *s.* Dillions Loyal 7555, *d.* Lock Knelle 2nd 23244 *by* Bolebroke Harlequin 3rd 6247.

857 **II.**—EDWARD HURTLEY, Crowborough Warren, Sussex, for **Crowborough Warren Briar 8th**, born Jan. 28; *s.* Dillions Honest 7050, *d.* Lock Briar 2nd 21914 *by* Jacobite 5116.

856 **III.**—BRIG.-GENERAL G. HOLDSWORTH, C.B., C.M.G., Glynde Place, Glynde, Sussex, for **Caburn Darkey 21st**, born Feb. 2; *s.* Caburn Diploma 6370, *d.* Caburn Darkey 2nd 22721 *by* Hermitage King 5629.

859 **R.N.**—COL. J. R. WARREN, O.B.E., M.C., for **Handcross Heedless 2nd**.

Welsh.

Classes 124 to 128.—*Cancelled under Regulation* 10 *of the Prize Sheet.*

Longhorns.

Class 129.—*Longhorn Bulls, born in or before* 1933.

863 **I. & Champion.[5]**—R. S. WALTERS, Norfolk Lodge, Sutton Coldfield, for **Sutton Victor 948**, red, brindle and white, born March 27, 1929; *s.* Arden Final 891, *d.* Lady Violet of Kent *by* Admiral 632.

862 **II.**—R. S. WALTERS, for **Sutton Spes 976**, red, brindle and white, born April 2, 1932; *s.* Sutton Victor 948, *d.* Friar Special *by* Friar Pop 902.

861 **III.**—T. G. ARNOLD, Ashgrove, Warwick Road, Solihull, for **Finham Victor 972**, red, brindle and white, born May 16, 1933, bred by R. R. Hollick, Stivichall, Coventry; *s.* Westwood Victor 966, *d.* Finham Princess 5th *by* Sutton Rufus 930.

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[1] Champion Silver Medal given by the Sussex Herd Book Society for the best Bull.
[2] Perpetual Silver Challenge Trophy given through the Sussex Herd Book Society for the best Bull.
[3] Perpetual Silver Challenge Cup given by the Sussex Cattle Breeders' Society of South Africa for the best Sussex.
[4] Champion Silver Medal given by the Sussex Herd Book Society for the best Cow or Heifer.
[5] Perpetual Silver Challenge Cup given by the Longhorn Cattle Society for the best Senior Longhorn.

Class 130.—*Longhorn Bulls, born in* 1934.

864 I. & Champion.[1]—R. S. WALTERS, Norfolk Lodge, Sutton Coldfield, for **Sutton Venture**, red, brindle and white, born Oct. 29; *s.* Sutton Spec 976, *d.* Sutton Viola (Vol. 17, p. 14) *by* Arden Final 891.

865 II.—R. S. WALTERS, for **Sutton Victor 2nd**, red, brindle and white, born March 8; *s.* Sutton Spec 976, *d.* Lady Violet of Kent *by* Admiral 632.

Class 131.—*Longhorn Cows or Heifers, in-milk, born in or before* 1932.

866 I. & R.N. for Champion.[2]—W. E. SWINNERTON, Crickley Barrow House, Northleach, for **Crickley Chestnut** (Vol. 17, p. 11), red and white, born March 31, 1931, calved June 11, 1935; *s.* Waddon Duke 950, *d.* Chestnut of Chippinghurst *by* Park Royal 777.

867 II.—W. E. SWINNERTON, for **Crickley Violet** (Vol. 16, p. 13), red, brindle and white, born June 7, 1928, calved June 25, 1935; *s.* Arden Dairyman 890, *d.* Violet of Chippinghurst *by* Chippinghurst Chief 861.

869 III.—R. S. WALTERS, Norfolk Lodge, Sutton Coldfield, for **Sutton Viola** (Vol. 17, p. 14), red, brindle and white, born March 31, 1930, calved Oct. 29, 1934; *s.* Arden Final 891, *d.* Lady Violet of Kent *by* Admiral 632.

Class 132.—*Longhorn Heifers, born in* 1933 *or* 1934.

873 I. & R.N. for Champion.[1]—R. S. WALTERS, Norfolk Lodge, Sutton Coldfield, for **Sutton Vivi 3rd** (Vol. 18, p. 13), red, brindle and white, born Feb. 26, 1933; *s.* Sutton Victor 948, *d.* Lady Violet of Kent *by* Admiral 632.

871 II.—W. E. SWINNERTON, Crickley Barrow House, Northleach, for **Crickley Hazel**, red, brindle and white, born Jan. 4, 1934; *s.* Crickley Forester 952, *d.* Crickley Chestnut (Vol. 17, p. 11) *by* Waddon Duke 950.

870 III.—FRED BILLING, Whoberley Hall, Coventry, for **Coventrie Royal Ruth** (Vol. 18, p. 15), plum, brindle and white, born July 2, 1933; *s.* Westwood Victor 966, *d.* Coventrie Ruth *by* Sutton Rufus 930.

872 R.N.—W. E. SWINNERTON, for **Stivichall Ruby 9th**.

Aberdeen-Angus.

Class 133.—*Aberdeen-Angus Bulls, born on or before November* 30, 1932.

874 I., Champion,[3] Champion[4] & Champion.[5]—VISCOUNT ALLENDALE, Bywell, Stocksfield-on-Tyne, for **Pelorus of Bywell 78476**, born Dec. 13, 1930; *s.* Elurio of Nisbethill 67008, *d.* Primrose of Bywell 77907 *by* Verigood of Bywell 55942.

889 II., R.N. for Champion[3] & R.N. for Champion.[4]—LADY ROBINSON, Kirklington Hall, Newark, for **Prince Ben of Boghead 78685**, born Feb. 8, 1931, bred by James Duff, Boghead, Huntly, Aberdeenshire; *s.* Geodesy of Bleaton 70819, *d.* Pride 74th of Coynachie 82861 *by* Gleam of Lochbank 54945.

885 III.—SIR PRINCE PRINCE-SMITH, BART., Southburn, Driffield, for **Ecliptic of Southburn 80236**, born Feb. 8, 1932; *s.* Primary of Dunira 62646, *d.* Eclat of Southburn 85325 *by* Rufus of Buckland 53693.

879 IV.—SIR EDMUND FINDLAY, BART., Aberlour, Banffshire, for **Euxidor 3rd 77307**, born Jan. 2, 1931; *s.* Prince Pride of Duthil 57900, *d.* Euxida 2nd 83706 *by* Evident of Ballindalloch 54803.

884 R.N.—LORD MOSTYN, Mostyn Hall, Mostyn, Flintshire, for **Evasion 2nd of Kinermony**.

Class 134.—*Aberdeen-Angus Bulls, born on or between December* 1, 1932, *and November* 30, 1933.

890 I.—VISCOUNT ALLENDALE, Bywell, Stocksfield-on-Tyne, for **Jellaba Eris 84640**, born Feb. 21, 1933, bred by J. E. Kerr, Harviestoun, Dollar; *s.* Equipment of The Laws 77121, *d.* Jewel Erica 87333 *by* Guardian of Candacraig 61908.

894 II.—LADY ROBINSON, Kirklington Hall, Newark, for **Kirriemuir of Kirklington 84843**, born Jan. 16, 1933; *s.* Prince Ben of Boghead 78685, *d.* Pride of Glenmoy 92192 *by* Hayston Ideal Ensign 57199.

895 III.—J. P. ROSS-TAYLOR, Mungoswalls, Duns, Berwickshire, for **Joskin of Bywell 84716**, born Jan. 28, 1933, bred by Viscount Allendale, Bywell, Stocksfield-on-Tyne; *s.* Elurio of Nisbethill 67008, *d.* Jill of Bywell 92443 *by* Erebus of Harviestoun 56780.

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[1] Perpetual Silver Challenge Cup given by the Longhorn Cattle Society for the best Junior Longhorn.

[2] Perpetual Silver Challenge Cup given by the Longhorn Cattle Society for the best Senior Longhorn.

[3] Perpetual Silver Challenge Trophy given through the Aberdeen-Angus Cattle Society for the best Bull.

[4] Champion Gold Medal given by the Aberdeen-Angus Cattle Society for the best Aberdeen-Angus.

[5] Silver Medal given by the English Aberdeen-Angus Cattle Association for the best Aberdeen-Angus bred in England or Wales.

893 R.N.—THE EYNSHAM ESTATE CO., Eynsham Hall, Witney, Oxon, for **Black Boy of Ettington.**

894, 937, 955 Special.[1]—LADY ROBINSON, for **Kirriemuir of Kirklington, Eyebright of Kirklington and Iris of Kirklington.**

874, 897, 941, R.N. for Special.[1]—VISCOUNT ALLENDALE, for **Pelorus of Bywell, Elmhore of Bywell and Pride of the Dene.**

Class 135.—*Aberdeen-Angus Bulls, born on or between December* 1, 1933, *and November* 30, 1934.

899 I.—CAPT. F. B. ATKINSON, Gallowhill, Morpeth, for **Elver of Gallowhill 87177**, born April 16, 1934; *s.* Gallowhill Beauty 80981, *d.* Elysia of Lochlane 101054 *by* Editor of Ballindalloch 63912.

897 II.—VISCOUNT ALLENDALE, Bywell, Stocksfield-on-Tyne, for **Elmhore of Bywell 87157**, born Dec. 29, 1933; *s.* Pelorus of Bywell 78476, *d.* Elmira of Bywell 95610 *by* Erebus of Harviestoun 56780.

900 III.—COL. J. F. N. BAXENDALE, Froxfield Green, Petersfield, for **Event of Froxfield 87530**, born Jan. 1, 1934; *s.* Beelsby Elvino 60704, *d.* Ebony of Sachel 93815 *by* Black Brutus of Llantwit 63386.

906 IV.—ROBERT MCVITIE GRANT, Logie Home Farm, Dunphail, Forres, for **Emperor of Logie 87217**, born April 2, 1934; *s.* Gandell 80993, *d.* Ebeletta of Ballindalloch 81129 *by* Evolensign of Ballindalloch 54808.

902 R.N.—BARONESS BURTON, Rangemore Hall, Burton-on-Trent, for **Evasit of Harviestoun.**

Class 136.—*Aberdeen-Angus Cows or Heifers, in-milk, born on or before November* 30, 1932.

916 I. & R.N. for Champion.[2]—THE EARL OF ELGIN, K.T., C.M.G., Broomhall, Dunfermline, for **Everesay of Broomhall 90007**, born Dec. 5, 1928, calved Dec. 8, 1934; *s.* Essayist of Bleaton 54689, *d.* Evergreen of Rosebrae 70532 *by* Evermore of Ballindalloch 45873.

917 II.—CAPT. A. L. GOODSON, Kilham, Mindrum, Northumberland, for **Black Briar of Kilham 96606**, born March 1, 1931, calved Jan. 20, 1935; *s.* Embos of Blaeton 56712, *d.* Blackberry of Kilham 90246 *by* Kythe of Dunira 64963.

920 III.—COL. NORMAN KENNEDY, D.S.O., Doonholm, Ayr, for **Bettine of Doonholm 100117**, born Feb. 19, 1932, calved Jan. 5, 1935; *s.* Mohawk of Doonholm 74707, *d.* Bettina of Doonholm 78885 *by* Prince Benson of Ballindalloch 51308.

913 R.N.—CAPT. F. B. ATKINSON, Gallowhill, Morpeth, for **Gem of Gallowhill 2nd.**

Class 137.—*Aberdeen-Angus Heifers, born on or between December* 1, 1932, *and November* 30, 1933.

926 I., R.N. for Champion[3] & Champion.[2]—J. J. CRIDLAN, Maisemore Park, Gloucester, for **Pride of Maisemore 55th 102234**, born Dec. 19, 1932; *s.* Proud Eric of Maisemore 57939, *d.* Pride of Maisemore 27th 78290 *by* Evader of Harviestoun 52626.

937 II.—LADY ROBINSON, Kirklington Hall, Newark, for **Eyebright of Kirklington 103946**, born March 12, 1933; *s.* Prince Ben of Boghead 78685, *d.* Eilenora of Candacraig 88776 *by* Bedouin of Candacraig 58361.

930 III.—SIR EDMUND FINDLAY, BART., Aberlour, for **Euxida 10th 102512**, born Dec. 25, 1932; *s.* Prince Pride of Duthil 57900, *d.* Euxida 80960 *by* Evident of Ballindalloch 54803.

938 IV.—J. P. ROSS-TAYLOR, Mungoswalls, Duns, Berwickshire, for **Mungos Pryde 2nd 103995**, born Dec. 5, 1932; *s.* Mungos Gregalach 71490, *d.* Pride of Benaulder 73463 *by* Watchman of Ballindalloch 87101.

934 V.—W. GILCHRIST MACBETH, Dunira, Comrie, Perthshire, for **Black Beronia 2nd of Dunira 103182**, born Feb. 9, 1933; *s.* Erman of Dunira 70474, *d.* Black Beronia of Doonholm 78886 *by* Prince Benson of Ballindalloch 51308.

922 R.N.—CAPT. F. B. ATKINSON, Gallowhill, Morpeth, for **Europa of Gallowhill.**

Class 138.—*Aberdeen-Angus Heifers, born on or between December* 1, 1933, *and November* 30, 1934.

955 I.—LADY ROBINSON, Kirklington Hall, Newark, for **Iris of Kirklington 107012**, born Dec. 26, 1933; *s.* Prince Ben of Boghead 78685, *d.* Idyllina 2nd of Bladen 96215 *by* Borodin of Candacraig 63511.

941 II.—VISCOUNT ALLENDALE, Bywell, Stocksfield-on-Tyne, for **Pride of the Dene 104652**, born Dec. 9, 1933; *s.* Pelorus of Bywell 78476, *d.* Pride of Tyneholm 95619 *by* Ellurio of Nisbethill 67008.

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[1] Special "Silver Jubilee" Gold Medal is offered by the Aberdeen-Angus Cattle Society, for the best group of three Aberdeen-Angus, bred by Exhibitor.

[2] Gold Medal given by the English Aberdeen-Angus Cattle Association for the best animal of the opposite sex to that of the animal awarded the Champion Gold Medal of the Aberdeen-Angus Cattle Society.

[3] Silver Medal given by the English Aberdeen-Angus Cattle Association for the best Aberdeen-Angus bred in England or Wales.

954 III.—LADY ROBINSON, for **Balsam of Kirklington** 107011, born Dec. 5, 1933; *s.* Prince Ben of Boghead 78685, *d.* Bullita of Pitskelly 91308 *by* Hayston Insiza 61928.
953 IV.—SIR PRINCE PRINCE-SMITH, BART., Southburn, Driffield, for **Elda of Southburn** 106873, born Jan. 15, 1934; *s.* Ernest of Harviestoun 80620, *d.* Elfreda of Southburn 91407 *by* Junius of Bywell 64891.
957 V.—J. P. ROSS-TAYLOR, Mungoswalls, Duns, Berwickshire, for **Mungos Bertha** 107050, born Dec. 26, 1933; *s.* Mungos Gregalach 71490, *d.* Belinda 7th of Braevail 73023 *by* Prince of Parade 42304.
945 R.N.—THE EARL OF DURHAM, Lambton Castle, Fence Houses, for **Bibana.**
Cup.[1]—VISCOUNT ALLENDALE and LADY ROBINSON equal points.
Specials.[2]—I. £8, VISCOUNT ALLENDALE; II. £5, CAPT. F. B. ATKINSON; III. £3, CAPT. A. L. GOODSON.

Belted Galloways.

Class 139.—*Belted Galloway Bulls, born on or before November* 30, 1934.

959 I. & Champion.[3]—J. DOUGLAS BROWN, Corseyard, Borgue, Kirkcudbright, for **Knockbrex Goliath** 887 B., born April 19, 1929; *s.* Knockbrex Dragon 601 B., *d.* Knockbrex Claire 762 B. *by* Knockbrex Pollux 49 B.
961 II. & R.N. for Champion.[3]—THE MARQUIS OF BUTE, K.T., Craigeach, Kirkcowan, Wigtownshire, for **Mochrum Defiance of Craigeach** 1099 B., born Dec. 15, 1933; *s.* Mochrum Royal Record 2nd 1039 B., *d.* Mochrum Confidence of Craigeach 1420 B. *by* Boreland Pharoh 90 B.
964 III.—THE NALC COMPANY, LTD., Gartmore, Stirling, for **Gartmore Peter** 1033 B., born Jan. 24, 1932, bred by Sir August Cayzer, Bart., Gartmore; *s.* Gartmore Nigel 839 B., *d.* Gartmore Soncie 3rd 1626 B. *by* Mark Hector 56 B.
962 R.N.—GEN. SIR IAN HAMILTON, 1, Hyde Park Gardens, London, W., for **Lullenden Concrete.**

Class 140.—*Belted Galloway Cows or Heifers, in-milk, born on or before November* 30, 1932.

967 I.—THE MARQUIS OF BUTE, K.T., Craigeach, Kirkcowan, for **Mochrum Confidence** 1420 B., born Feb. 2, 1927, calved Dec. 18, 1934; *s.* Borland Pharoh 90 B., *d.* Mochrum Emma of Craigeach 387 B. *by* Mochrum Royal Record of Craigeach 61 B.
966 II.—J. DOUGLAS BROWN, Corseyard, Borgue, Kirkcudbright, for **Knockbrex Fleur de Lys** 1596 B. (D), born March 5, 1928, calved Dec. 24, 1934; *s.* Knockbrex Dragon 601 B., *d.* Knockbrex Pansy 183 B. (D) *by* Boreland Champion 22 B. (D).
969 III.—GEN. SIR IAN HAMILTON, 1, Hyde Park Gardens, London, W., for **Lullenden Estelle 2nd** 2118 B., born Jan. 17, 1930, calved Dec. 16, 1934; *s.* Lullenden Falstaff 697 B., *d.* Gartmore Estelle 1st 1030 B. *by* Mark Hector 56 B.
971 R.N.—THE NALC COMPANY, LTD., Gartmore, Stirling, for **Gartmore Mary 2nd.**

Class 141.—*Belted Galloway Heifers, born on or before December* 1, 1932, *and November* 30, 1933.

974 I.—THE NALC COMPANY, LTD., Gartmore, Stirling, for **Gartmore Christian 3rd** 3220 B., born March 4, 9133; *s.* Knockbrex Eagle 685 B., *d.* Nan of Auchengassel 27570 *by* Tramp of Auchengassel 13488.
972 II.—J. DOUGLAS BROWN, Corseyard, Borgue, Kirkcudbright, for **Knockbrex Kitty** 3250 B., born March 12, 1933; *s.* Knockbrex Goliath 887 B., *d.* Knockbrex Pansy 183 B. (D) *by* Boreland Champion 21 B. (D).
973 III.—GEN. SIR IAN HAMILTON, 1, Hyde Park Gardens, London, W., for **Lullenden Betty** 3282 B., born April 2, 1933; *s.* Knockbrex Heron 955 B, *d.* Gartmore Grace 3rd 1032 B. *by* Mark Hector 56 B.

Class 142.—*Belted Galloway Heifers, born on or between December* 1, 1933, *and November* 30, 1934.[4]

977 I.—GEN. SIR IAN HAMILTON, 1, Hyde Park Gardens, London, W., for **Lullenden Etty** 3418 B., born Jan. 12, 1934; *s.* Lullenden Concrete 983 B., *d.*, Gartmore Grace 3rd 1032 B. *by* Mark Hector 56 B.
980 II.—THE NALC COMPANY, LTD., Gartmore, Stirling, for **Gartmore Mona 1st** 3336 B., born Dec. 23, 1933; *s.* Knockbrex Eagle 685 B., *d.* Gartmore Heather 9th 2254 B. *by* Knockbrex Eagle 685 B.

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[1] The "Mungoswalls" Silver Challenge Cup given through the English Aberdeen-Angus Cattle Association for the most points awarded in a combination of entries in Classes 133 to 138.
[2] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the Aberdeen-Angus Classes.
[3] The "Knockbrex" Perpetual Silver Challenge Cup given through the Dun and Belted Galloway Cattle Breeders' Association for the best Belted Galloway.
[4] Prizes given by the Dun and Belted Galloway Cattle Breeders' Association.

979 III.—THE NALO COMPANY, LTD., for **Gartmore Helen 2nd** 3328 B., born March 7, 1934; *s.* Glenzier Watermark 725 B., *d.* Gartmore Helen 1st 1322 B. *by* Mark Hector 56 B.
975 R.N.—J. DOUGLAS BROWN, Corseyard, Borgue, Kirkcudbright, for **Knockbrex Lorna.**
H.C.—976. C.—978.

Galloways.

Class 143.—*Galloway Bulls, born on or before November* 30, 1934.

988 I.—FRANCIS W. WALKER, Leys Castle, Inverness-shire, for **Kirklands Private** 19006, born April 11, 1933, bred by W. R. Gaskell, Kirklands, Kirkconnel; *s.* Grange Juryman 17253, *d.* Zeppelin of Waterside 30609 *by* Zoca of Auchengassel 15058.
986 II.—ROBERT JARDINE PATERSON, Balgray, Lockerbie, for **Exclusive of Balgray** 19107, born Dec. 5, 1932; *s.* Magnate of Drumlanrig 17674, *d.* Bell 3rd of Askerton 30292 *by* War Bond 2nd of Corrie Halls 14837.
982 III.—ARTHUR B. DUNCAN, Gilchristland, Closeburn, Dumfriesshire, for **John S.T. of Blair** 18512, born April 21, 1932, bred by John Black, Blair, Maybole; *s.* Pocket Money of Drumlanrig 16094, *d.* Alexa of Blair 28933 *by* Tarbreoch Knight 14095.
985 R.N.—W. KENNEDY-MOFFATT, Auchencheyne, Moniaive, Dumfriesshire, for **Teetotum of Seroggiehall.**

Class 144.—*Galloway Cows or Heifers, in-milk, born on before November* 30, 1932.

991 I. & Champion.[1]—SIR JOHN WM. BUCHANAN-JARDINE OF CASTLEMILK, BART., Castle Milk, Lockerbie, for **Nazetta 3rd of Castle Milk** 30930, born April 7, 1926, calved May 8, 1935, bred by Sir R. W. Buchanan-Jardine, Bart., Castle Milk; *s.* Morman of Dalwyne 12617, *d.* Nazetta of Castle Milk 25927 *by* Kitchener of Mossknowe 12246.
992 II. & R.N. for Champion.[1]—ARTHUR B. DUNCAN, Gilchristland, Closeburn, for **Wells Ruby Princess 5th** 31772, born Feb. 25, 1927, calved Dec. 12, 1934, bred by John Scott, Brow Wells, Ruthwell, Carlisle; *s.* Yardstick of Auchengassel 14774, *d.* Drumhumphry Ruby Princess 2nd 29352 *by* Sir Furmiston of Craigneston 14154.
994 III.—CHARLES S. FORRESTER, Skitby, Kirklinton, Carlisle, for **Baroness 15th of Skitby** 31376, born Jan. 2, 1926, calved Dec. 15, 1934, bred by George Forrester, Skitby; *s.* Barmark Merlin 2nd 15554, *d.* Baroness 13th of Skitby 23373 *by* John Bull 11552.
989 R.N.—SIR JOHN WM. BUCHANAN-JARDINE OF CASTLEMILK, BART., for **Barmark Lady Nancy 6th.**

Class 145.—*Galloway Heifers, born on or between December* 1, 1932, *and November* 30, 1933.

1008 I.—ROBERT JARDINE PATERSON, Balgray, Lockerbie, for **Arun Lily of Balgray** 35875, born March 20, 1933; *s.* Conjuror of Stepford 18102, *d.* Lily of Balgray 33743 *by* Tarbreoch Knight 15526.
1005 II.—ROBERT GRAHAM, Chapel of Logan, Canonbie, for **Logan Lady 35th** 35813, born Jan. 2, 1933; *s.* Tuscan of Beechwood 17020, *d.* Logan Lady 11th 28559 *by* Horace of Killearn 14429.
1007 III.—D. & J. LITTLE, Whitehill, Lockerbie, for **Nettie 28th of Whitehill** 35929, born April 7, 1933; *s.* Barmark Independence 2nd 16149, *d.* Nettie 3rd of Corriehall 25993 *by* Matthew Mark 10726.
1003 R.N.—FRANCIS N. M. GOURLAY, Kirkland, Tynron, for **Girl Guide 2nd.**
H.C.—1000. C.—1004.

Class 146.—*Galloway Heifers, born on or between December* 1, 1933, *and November* 30, 1934.[2]

1014 I.—FRANCIS N. M. GOURLAY, Kirkland, Tynron, Dumfriesshire, for **Talitha** 36961, born Jan. 7, 1934; *s.* Grange Juryman 17253, *d.* Dun Lizzie of Kirklands 32115 *by* Craigneston Glory 15308.
1017 II.—W. KENNEDY-MOFFAT, Auchencheyne, Moniaive, Dumfriesshire, for **Lena 2nd of Lochurr** 36632, born Jan. 7, 1934; *s.* Radium of Tundergarth Mains 16747, *d.* Lena of Lochurr 32267 *by* Warfare of Waterside 15721.
1009 III.—SIR JOHN WM. BUCHANAN-JARDINE OF CASTLEMILK, BART., Castle Milk, Lockerbie, for **Beatrice 2nd of Castle Milk** 36605, born Jan. 30, 1934; *s.* Jurist of Drumlanrig 17675, *d.* Beatrice of Castle Milk 34473 *by* Warfare of Waterside 15721.
1010 IV.—SIR JOHN WM. BUCHANAN-JARDINE OF CASTLEMILK, BART., for **Lilac 3rd of Castle Milk** 36611, born March 14, 1934; *s.* Excelsior of Castle Milk 15884, *d.* Lilac of Castle Milk 33728 *by* Leo of Castle Milk 15883.
1013 R.N.—CHARLES S. FORRESTER, Skitby, Kirklinton, Carlisle, for **Monica of Skitby.**
H.C.—1012. C.—1016, 1018, 1019.

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[1] The "Jubilee" Perpetual Silver Challenge Cup given by the Galloway Cattle Society for the best Galloway.
[2] Prizes given by the Galloway Cattle Society.

Highland.[1]

Class 147.—*Highland Bulls, born on or before November* 30, 1933.

1021 I.—MRS. LEES-MILNE, Killundine, Drimnin, Oban, Argyll, for **An Gille Snasar of Killundine 3743**, brindle, born May 2, 1933; *s.* An Gille Siobhalt 3520, *d.* Riabhach Mhollach 3rd of Bochastle 10076 *by* Righ of Morven 2605.

1022 II.—FRANCIS W. WALKER, Leys Castle, Inverness-shire, for **Duke of Leys 3757**, brindle, born March 7, 1933; *s.* Clais Dhearg of Achnacloich 3553, *d.* Donnag Riabhach 20th of Atholl 10351 *by* Iarla Buidhe of Atholl 3650.

Class 148.—*Highland Bulls, born on or after December* 1, 1933.

1029 I.—JOHN G. MORRISON, Islay House, Bridgend, Islay, Argyll, for **Fear Tagraidh Ile 3823**, red, born Feb. 25, 1934; *s.* Culnadalloch 2nd of Achnacloich 3441, *d.* Lady Smith 6th of Stronvar 10678 *by* Auchmar 3053.

1027 II.—EDWARD LOWES, Charlwood House, Lowfield Heath, Crawley, for **Culnadalloch 7th of Achnacloich 3809**, red, born Jan. 16, 1934, bred by T. E. Nelson, Achnacloich, Argyllshire; *s.* Culnadalloch-a-Rithist of Achnacloich 3638, *d.* Dosan Buidhe of Achnacloich 9833 *by* Douglas 2557.

1024 III.—MRS. LEES-MILNE, Killundine, Drimnin, Oban, Argyll, for **An Barraiche of Killundine 3812**, red, born May 1, 1934; *s.* An Baidhach of Killundine 3657, *d.* Baravalla Smiorail 5th of Kilberry 9904 *by* Dughall Ruadh 3306.

Class 149.—*Highland Cows, with calf at foot.*

1035 I.—MRS. LEES-MILNE, Killundine, Drimnin, Oban, Argyll, for **Una Bhuidhe 3rd of Killundine 10586**, yellow, born May 3, 1931, calved Sept. 27, 1934; *s.* Prionnsa Bhuidhe 3581, *d.* Una 3rd of Farr 9915 *by* Eachann of Ensay 3291.

1038 II.—FRANCIS W. WALKER, Leys Castle, Inverness-shire, for **Una 4th of Flichity 10443**, white, born June 10, 1929, calved April 5, 1935, bred by Lord Invernairn, Flichity, Inverness; *s.* Gilleasburg of Flichity 3395, *d.* Una of Farr 9355 *by* Silvio 3019.

1031 III.—JAMES P. DALGLEISH, Westgrange, Newmills, Dunfermline, for **Violet 11th of Kilchamaig 10622**, red, born April 2, 1931, calved Feb. 22, 1935, bred by Miss L. C. Turner, Kilchamaig, Whitehouse, Argyll; *s.* Colkitto 3422, *d.* Violet 6th 10482 *by* Carrick Innes of Logan 2906.

1036 R.N.—FRANCIS W. WALKER, for **Annag Ruadh of Bochastle.**

Class 150.—*Highland Heifers, born on or after December* 1, 1932.

1046 I.—MRS. LEES-MILNE, Killundine, Drimnin, Oban, Argyll, for **Baravalla Smiorail 2nd of Killundine 10636**, red, born Jan. 8, 1933; *s.* An Gille Siobhalt 3520, *d.* Baravalla Smiorail 5th of Kilberry 9904 *by* Dughall Ruadh 3306.

1053 II.—JOHN G. MORRISON, Islay House, Bridgend, Islay, Argyll, for **Annag Ruadh Ile 4th 10694**, red, born March 15, 1933; *s.* Culnadalloch 2nd of Achnacloich 3441, *d.* Annag Ruadh 3rd of Atholl 10686 *by* Righ Calum-na-Morairne 2817.

1058 III.—FRANCIS W. WALKER, Leys Castle, Inverness-shire, for **Seonaid 2nd of Leys 10655**, red, born Jan. 26, 1933; *s.* Clais Dhearg of Achnacloich 3553, *d.* Beithidh of Flichity 10355 *by* Bathar Taghte 3258.

1057 IV.—FRANCIS W. WALKER, for **Eilidh 2nd of Leys 10656**, red, born April 29, 1933; *s.* Clais Dhearg of Achnacloich 3553, *d.* Morag 4th of Flichity 10440 *by* Laoch of Flichity 3394.

1041 R.N.—JAMES P. DALGLEISH, Westgrange, Newmills, Dunfermline, for **Caplesdh 15th of Achnacloich.**

Dairy Shorthorns.

Class 151.—*Dairy Shorthorn Bulls, born in or before* 1932.

1063 I. & Champion.[2]—JOSEPH HOPE, Ireby Hall, Ireby, Carlisle, for **Greencroft Marquis 257658**, roan, born Feb. 19, 1932, bred by A. Ritson, Greencroft, Ireby; *s.* Dewdrop's Squire 222633, *d.* 78802 Cressida 91st *by* Ireby Magic 172723.

1067 II.—ROBERT N. TORY, Anderson, Blandford, for **Anderson Imperial Minstrel 2nd 234697**, white, born May 2, 1929, bred by Debenham & Tory, Anderson, Blandford; *s.* Anderson Bates 15th 220511, *d.* 25049 Fulmer Melody *by* Leam Commissioner 149958.

1060 III.—CHIVERS & SONS, LTD., Histon, Cambridge, for **Royal Foggathorpe Prince 253513**, roan, born Nov. 4, 1931, bred by D. Jopson, Ormathwaite Hall, Keswick; *s.* Royal Oak 211121, *d.* 98551 Orma Foggathorpe *by* Wild Eyes Prince 212551.

1059 R.N.—MR. AND MRS. T. R. C. BLOFELD, Hoveton Home Farm, Wroxham, Norfolk, for **Streetly Lord York 4th.**

H.C.—1062, 1065.

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[1] £20 towards these Prizes were given by the Highland Cattle Society of Scotland.

[2] Champion Prize of £10 given by the Dairy Shorthorn Association and Shorthorn Society Joint Prize Fund for the best Bull.

1062, 1124, 1202 Cup.[1]—HOBBS & DAVIS, for Ilford Lord Lee 8th, Kelmscott Melody 84th and Kelmscott Lemhill 112th.
1109, 1161, 1182 R.N. for Cup.[1]—C. J. ALLDAY, for Fothering Fairy Duke 11th, Fothering Moss Rose 2nd and Fothering Lady Foggathorpe 2nd.

Class 152.—*Dairy Shorthorn Bulls, born in* 1933.

1078 I. & R.N. for Champion.[2]—HENRY J. RUMNEY, Pallet Hill, Penrith, for Wild Dairyman 267690, roan, born March 14, bred by J. Moffat, Summerhow, Kendal; *s.* Proud Prince 2nd 239580, *d.* 131462 Wild Queen 9th *by* Graceful Dairyman 215944.
1073 II.—LORD LOCH, Stoke College Street Farm, Stoke-by-Clare, Suffolk, for Stokecollege Lord Leicester 266971, roan, born Feb. 28; *s.* Stokecollege Secundus 258949, *d.* 131757 Leek Wild Duchess *by* Lord Leicester 83rd 231718.
1069 III.—JOHN CROWE, Ashe Manor, Overton, Hants., for Kirklevington Duke 264732, roan, born March 24; *s.* Barrington Duke 241931, *d.* 9533 Kirklevington 55th *by* Chieftain 141563.
1076 R.N.—MAJOR G. MILLER MUNDY, Red Rice, Andover, for Clanville Wild Bates.
H.C.—1070, 1074. C.—1072.

Class 153.—*Dairy Shorthorn Bulls, born on or between January* 1 *and March* 31, 1934.

1086 I.—ST. CLERE ESTATES, LTD., St. Clere, Kemsing, Sevenoaks, for St. Clere Prince Regent, dark roan, born March 25, bred by Sir Mark Collet, Bart., St. Clere, Kemsing; *s.* St. Clere Foggathorpe Primus 259987, *d.* 106312 St. Clere Millicent Duchess 6th *by* Leam Druid Master 173350.
1080 II.—JOHN BARNES, Aikbank, Wigton, for Wild Cumbrian 2nd, red, born Feb. 10, bred by J. & J. Willis, Croft House, Brocklebank, Wigton; *s.* Pearl's Radium 259209, *d.* 133934 Lena Wild Eyes 21st *by* Wild Eyes Fame 227388.
1084 III.—J. HEWSON & SONS, Parton, Wigton, for Rosamond's Champion, dark roan, born Jan. 1, bred by J. & J. Willis, Croft House, Brocklebank, Wigton; *s.* Pearl's Radium 259209, *d.* 79867 Fair Rosamond 3rd *by* Greenleaf's Milkman 172138.
1081 IV.—WILLIAM BARNES, The Street, Wigton, for Royal Prince, roan, born March 9, bred by N. Highmore, Tarn End Farm, Welton, Dalston, Cumberland; *s.* Whitecroft Autumn Prince 247943, *d.* 101517 Rosie Belle 45th *by* Olive's Gift 183620.
1093 R.N.—THE MARQUESS OF ZETLAND, G.C.S.I., G.C.I.E., Olliver, Richmond, Yorks., for Baron Bridekirk 127th.
H.C.—1082, 1089, 1090, 1092. C.—1085.

Class 154.—*Dairy Shorthorn Bulls, born on or between April* 1 *and June* 30, 1934.[3]

1107 I.—CECIL M. WILLS, Sherfield Court, Basingstoke, for Sherfield Graceful Lad, white, born April 1; *s.* Aldenham Kirklevington Duke 3rd 248242, *d.* 85722 Graceful Lady *by* Kingsthorpe Charming Duke 3rd 191157.
1105 II.—ST. CLERE ESTATES, LTD., St. Clere, Kemsing, Sevenoaks, for St. Clere Crown Prince, dark roan, born April 2, bred by Sir Mark Collet, Bart., St. Clere, Kemsing; *s.* Harehill St. Bardolph 2nd 230740, *d.* 72059 St. Clere Millicent 6th *by* Haddon Nonsuch 2nd 172198.
1098 III.—MISS R. M. HARRISON, O.B.E., Maer Hall, Newcastle, Staffs., for Townend Supreme, roan, born April 1, bred by J. Cowx, Town End, Uldale, Carlisle; *s.* Wreay Pilate 234517, *d.* 137279 Townend Pansy 12th *by* Best of All 235270.
1104 IV.—MAJOR G. MILLER MUNDY, Red Rice, Andover, for Redrice Craggsman 7th, red, born May 7; *s.* Redrice Chancellor 9th 253195, *d.* 141497 Redrice Craggs *by* Anderson Wild Bates 212935.
1103 R.N.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for Aldenham Wild Duke 3rd.
H.C.—1097, 1108. C.—1100.

Class 155.—*Dairy Shorthorn Bulls, born on or between July* 1 *and December* 31, 1934.

1109 I.—C. J. ALLDAY, Fotheringhay Manor, Peterborough, for Fothering Fairy Duke 11th, roan, born July 8; *s.* Royal Foggathorpe Prince 253153, *d.* 135322 Fothering Gay Duchess 2nd *by* Histon Foggathorpe Dairyman 216355.
1117 II.—J. HEWSON & SONS, Parton, Wigton, for Amshaugh Squire, red, born Aug. 8, bred by I. Harrison, Amshaugh, Alston; *s.* Calcaria What's Left 255891, *d.* 148871 Amshaugh Casket 6th *by* Farrar Rose Prince 3rd 243966.

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[1] The "Brackenhurst" Silver Challenge Bowl given through the Dairy Shorthorn Association for the best group of one Bull and two Cows or Heifers. Two at least of the animals must have been bred by the Exhibitor.
[2] Champion Prize of £10 given by the Dairy Shorthorn Association and Shorthorn Society Joint Prize Fund for the best Bull.
[3] Prizes, except Fourth, given by the Dairy Shorthorn Association and Shorthorn Society Joint Prize Fund.

1111 III.—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Johnby Duke**, roan, born Sept. 22; *s.* Histon White Duke 251445, *d.* 146703 Histon Johnby Rose *by* Thornby Dauntless Dairyman 152537.

1114 IV.—J. ONSLOW FANE, Steventon Manor, Hants., for **Steventon Sir Gracious**, roan, born Sept. 9; *s.* Dolphinlee Waterloo King 256938, *d.* 117948 Steventon Grace *by* Paccombe Minstrel 4th 225410.

1110 R.N.—JOSEPH BARNES, Barugh Syke, Wigton, for **Barugh Countryman**.
H.C.—1113, 1119. C.—1121.

Class 156.—*Dairy Shorthorn Cows, in-calf.*[1]

1124 I.—HOBBS & DAVIS, Kelmscott, Lechlade, for **108746 Kelmscott Melody 84th**, red, born June 3, 1928; *s.* Sorbrook Foggathorpe Premier 3rd 219269, *d.* 74962 Kelmscott Melody 73rd *by* Kelmscott Imperialist 82nd 190999.

1127 II.—J. TIMBERLAKE, Hastoe Farm, Tring, for **134005 Hastoe Beauty 7th**, red and little white, born Feb, 16, 1930; *s.* Double Imperial 206832, *d.* 80459 Hastoe Beauty 3rd *by* Dauntless Forager 180915.

1130 III.—G. H. WILLIS, Birdlip, Glos., for **118000 Rose Grey 8th**, roan, born Jan. 28, 1929, bred by J. K. & R. M. Fenwick, Lesson Hall, Wigton; *s.* Prince Supreme 210534, *d.* Rose Grey 6th *by* Verdun 139902.

1122 R.N.—J. ONSLOW FANE, Steventon Manor, Hants, for **Ithells Bracelet 2nd**.
H.C.—1126, 1129. C.—1128.

1127, 1141, 1147 **Cup.**[2]—J. TIMBERLAKE, for **Hastoe Beauty 7th, Hastoe Bective 4th and Hastoe Millicent 2nd.**

1124, 1201, 1202 **R.N. for Cup.**[2]—HOBBS & DAVIS, for **Kelmscott Melody 84th, Kelmscott Betty 37th and Kelmscott Lemhill 112th.**

Class 157.—*Dairy Shorthorn Cows, in-milk, born on or before March* 31, 1929, *having yielded a minimum of* 8,000 *lb. of milk during a lactation period of* 315 *days.*[1]

1139 I.—MAJOR G. MILLER MUNDY, Red Rice, Andover, for **118071 Knells Elliot Fernleaf 2nd**, roan, born March 16, 1929, calved April 22, 1935, bred by C. Fisher, Knells Farm, Carlisle; *s.* Favourite Blend 180751, *d.* 73396 Knells Elliot Fern *by* Walby Dairy King 194903.

1141 II.—J. TIMBERLAKE, Hastoe Farm, Tring, for **123876 Hastoe Bective 4th**, red, born March 11, 1929, calved June 4, 1935; *s.* Double Imperial 206832, *d.* 91901 Hastoe Bective 2nd *by* Broadfields Fearless 196741.

1132 III.—FREDERICK CHAPMAN, Moorpark Farm, Harrogate, for **105948 Blossom**, roan, born Jan. 24, 1928, calved June 11, 1935; *s.* Queen's Duke 193125, *d.* 34578 May Blossom 2nd *by* Beauty's Landmark 161253.

1137 R.N.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Aldenham Dot 6th.**
H.C.—1134. C.—1135.

1141, 1147, 1177 **Bowl.**[3]—J. TIMBERLAKE, for **Hastoe Bective 4th, Hastoe Millicent 2nd and Hastoe Bective 5th.**

1191, 1192, 1193 **R.N. for Bowl.**[3]—E. UWINS GILLATE, for **Cromarbry Brimstage, Cromarbry Rosemary 2nd and Cromarbry Wild Duchess.**

Class 158.—*Dairy Shorthorn Cows, in-milk, born on or between April* 1, 1929, *and March* 31, 1930, *having yielded a minimum of* 8,000 *lb. of milk during a lactation period of* 315 *days.*

1147 **I. & Champion.**[4]—J. TIMBERLAKE, Hastoe Farm, Tring, for **134012 Hastoe Millicent 2nd**, red and little white, born March 20, 1930, calved May 30, 1935; *s.* Double Imperial 206832, *d.* Millicent *by* Yeldersley Prince George 113741.

1149 II.—THE DUKE OF WESTMINSTER, G.C.V.O., D.S.O., Eaton Home Farm, Aldford, Chester, for **134422 Lawnhead Charming Lass 11th**, red, born March 6, 1930, calved May 27, 1935, bred by J. Washington Wardle, Mill House, Gt. Bridgeford, Stafford; *s.* Eaton Rose King 207056, *d.* 43832 Charming Lass 3rd *by* Lawnhead Cavalier 182413.

1143 III.—FREDERICK CHAPMAN, Moorpark Farm, Harrogate, for **116554 Primrose Gift**, red and little white, born Nov. 1, 1929, calved June 15, 1935; *s.* Sorbrook Summertime 194227, *d.* 16023 Primrose *by* Kelmscott Conjuror 137268.

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[1] Prizes, except Fourth, given by the Dairy Shorthorn Association and Shorthorn Society Joint Prize Fund.

[2] Perpetual Silver Challenge Cup and a cash prize of £40 given through the Dairy Shorthorn Association for the best group of three Cows or Heifers by the same sire. The sire must be living in the British Isles, and have produced living progeny in 1934. A cash prize of £10 was awarded in respect of the Reserve Group and a small replica of the Cup was given, through the Dairy Shorthorn Association, to the owner of the sire winning the Cup.

[3] The "Nottingham" Silver Challenge Bowl given through the Dairy Shorthorn Association for the best group of three Cows or Heifers in-milk in Classes 157 to 161.

[4] Champion Prize of £10, given by the Dairy Shorthorn Association and the Shorthorn Society Joint Prize Fund for the best Cow or Heifer.

1144 **R.N.**—CAPT. N. MILNE HARROP, Garthgynan, Ruthin, North Wales, for **Gwersyll Kirklevington.**
H.C.—1151. C.—1145.

Class 159.—*Dairy Shorthorn Cows, in-milk, born on or between April* 1, 1930, *and March* 31, 1931, *having yielded a minimum of* 6,500 *lb. of milk during a lactation period of* 315 *days.*

1158 **I.**—ST. CLERE ESTATES, LTD., St. Clere, Kemsing, Sevenoaks, for 129446 **Kelmscot Lovely 156th,** dark roan, born Sept. 2, 1930, calved March 30, 1935, bred by Hobbs & Davis, Kelmscott, Lechlade; *s.* Kelmscott Ringleader 41st 231196, *d.* 108742 Kelmscott Lovely 152nd *by* Sorbrook Foggathorpe Premier 3rd 219269.
1159 **II.**—G. H. WILLIS, Birdlip, Glos., for 136433 **Millbeck Benedict's Lucy 2nd,** roan, born Feb. 16, 1931, calved May 10, 1935, bred by J. F. S. & A. Brownrigg, Millbeck Hall, Keswick; *s.* Millbeck Standard 217596, *d.* 94578 Millbeck Benedict's Lucy *by* Embleton Prince 20711.

Class 160.—*Dairy Shorthorn Cows or Heifers, in-milk, born on or after April* 1, 1931, *having yielded a minimum of* 5,500 *lb. of milk during a lactation period of* 315 *days.*

1168 **I.**—SIR WILLIAM HICKING, BART., Brackenhurst Hall, Southwell, Notts., for 139333 **Brackenhurst Bonnie Jean,** roan, born May 4, 1931, calved May 27, 1935; *s.* Brackenhurst Red Prince 228455, *d.* 49994 Brackenhurst Jean *by* Royal Ringleader 166746.
1161 **II.**—C. J. ALLDAY, Fotheringhay Manor, Peterborough, for 135323 **Fothering Moss Rose 2nd,** red, born Aug. 18, 1931, calved June 19, 1935; *s.* Histon Foggathorpe Dairyman 216355, *d.* 70085 Fothering Scotch Rose *by* Longhills Lord Charlie 182651.
1162 **III.**—LT.-COL. R. W. BARCLAY, Bury Hill, Dorking, for 142022 **Lacy Foggathorpe 7th,** roan, born Aug. 31, 1931, calved May 20, 1935, bred by Percy Perkins, The Bowers, Holme Lacy, Hereford; *s.* Lacy Publisher 208868, *d.* 83662 Thurnham Foggathorpe 7th *by* Thurnham Lord Cran 203436.
1174 **IV.**—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for 141437 **Aldenham Wild Queen 18th,** light roan, born Oct. 8, 1931, calved May 7, 1935; *s.* Loobagh Dreadnought 13th 224619, *d.* 111005 Aldenham Wild Queen 9th *by* Aldenham Lord Barrington 3rd 195553.
1177 **V.**—J. TIMBERLAKE, Hastoe Farm, Tring, for 143878 **Hastoe Bective 5th,** red, born Sept. 21, 1931, calved May 27, 1935; *s.* Frontier Fame 237229, *d.* 123876 Hastoe Bective 4th *by* Double Imperial 206832.
1178 **R.N.**—THE DUKE OF WESTMINSTER, G.C.V.O., D.S.O., Eaton Home Farm, Aldford Chester, for **Eaton Belle 14th.**
H.C.—1164. C.—1172, 1175, 1179.

Class 161.—*Dairy Shorthorn Heifers, in-milk to first calving, born on or after April* 1, 1932.[1]

1192 **I. & R.N. for Champion.**[2]—E. UWINS GILLATE, Shawlands, Lingfield, for 148442 **Cromarbry Rosemary 2nd,** roan, born June 24, 1932, calved May 26, 1935; *s.* Streetly Lord Barrington 2nd 240567, *d.* 96921 Rosemary 2nd *by* Aikton Sabre 2nd 195523.
1214 **II.**—CAPT. ARNOLD S. WILLS, Thornby Hall, Northampton, for 154473 **Thornby Foggathorpe 47th,** white, born June 3, 1932, calved June 7, 1935; *s.* Thornby Royalist Foggathorpe 2nd 219664, *d.* 103820 Thornby Foggathorpe 30th *by* Thornby Royal Cran 185653.
1200 **III.**—LAWRENCE HIGNETT, Hook End Farm, Checkendon, Reading, for 149123 **Checkendon Waterloo Cran 2nd,** roan, born July 16, 1932, calved April 27, 1935; *s.* Double Imperial 206832, *d.* 97782 Checkendon Wild Cran *by* Ashe Wild Prince 3rd 204565.
1191 **IV.**—E. UWINS GILLATE, for 148435 **Cromarbry Brimstage,** roan, born Sept. 17, 1932, calved May 25, 1935; *s.* Streetly Lord Barrington 2nd 240567, *d.* 88160 Illington Brimstage 12th *by* Shawwood Regal Dairyman 176054.
1202 **V.**—HOBBS & DAVIS, Kelmscott, Lechlade, for 149247 **Kelmscott Lemhill 112th,** red, born April 2, 1932, calved May 7, 1935; *s.* Sorbrook Foggathorpe Premier 3rd 219269, *d.* 50179 Kelmscott Lemhill 85th *by* Creme de Menthe 119683.
1182 **R.N.**—C. J. ALLDAY, Fotheringhay Manor, Peterborough, for **Fothering Lady Foggathorpe 2nd.**
H.C.—1183, 1193, 1199, 1201. C.—1188.
Special.[3]—I. £8, THOMAS HUTCHINSON, Clickemin Farm, Ponteland, Newcastle-on-Tyne.

[1] Prizes, except Fourth, given by the Dairy Shorthorn Association and Shorthorn Society Joint Prize Fund.
[2] Champion Prize of £10, given by the Dairy Shorthorn Association and the Shorthorn Society Joint Prize Fund for the best Cow or Heifer.
[3] Special Prize given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the Dairy Shorthorn Classes.

Lincolnshire Red Shorthorns.

Class 162.—*Lincolnshire Red Shorthorn Bulls, born in or before* 1933.

1221 I. & Champion.[1]—E. S. TANSLEY, Bramcotte Hills, Nottingham, for **Seaholm Exchequer** 26129, born June 29, 1931; *s.* Anwick Exchequer 23424, *d.* Cockerington No. 148 *by* Petwood Normanby 19700.

1222 II.—LEONARD WELLS, The Homestead, North Scarle, Lincoln, for **Chetwode Tinker** 27059, born June 18, 1933, bred by Louis Fleischmann, Chetwode Manor, Buckingham; *s.* Melton Underporter 26030, *d.* Chetwode Quaver *by* Harrington Harrington 22972.

1220 III.—THE EXORS. OF J. G. MCDOUGALL, Chippinghurst Manor, Cuddesdon, Oxon., for **Owmby Bowler 31st** 27347, born May 12, 1933, bred by J. T. Greenfield, Owmby, Lincoln; *s.* Anderby Bowler 24290, *d.* Owmby No. 78 *by* Tathwell Cherryplum 22555.

1218 R.N.—H. GORE BROWNE, Broombriggs, Woodhouse, Loughborough, for **Anderby Ford.**

Class 163.—*Lincolnshire Red Shorthorn Bulls, born in* 1934.

1224 I. & R.N. for Champion.[1]—W. DENNIS & SONS, LTD., Kirton, Boston, for **Walcott Envoy 6th**, born April 8, bred by John Bembridge, Walcott, Lincoln; *s.* Melton Triumph 25360, *d.* Navenby Anwick (Vol. 30, p. 279) *by* Scampton Sandow 13838.

1228 II.—E. S. TANSLEY, Bramcotte Hills, Nottingham, for **Seaholm Bob 26th**, born May 16; *s.* Anderby Bob 24281, *d.* Seaholm Charm (Vol. 36, p. 347) *by* Anwick Accurate 21848.

1225 III.—THE EXORS. OF J. G. MCDOUGALL, Chippinghurst Manor, Cuddesdon, Oxon., for **Chippinghurst Columbus**, born March 9, bred by J. G. McDougall; *s.* Anderby Dipper 25701, *d.* Horkstownian Dainty (Vol. 38, p. 329) *by* Melton Queen's Jester 23063.

1223 R.N.—H. GORE BROWNE, Broombriggs, Woodhouse, Loughborough, for **Broombriggs Bumper.**

Class 164.—*Lincolnshire Red Shorthorn Cows or Heifers, in-milk, born in or before* 1932.[2]

1231 I. & R.N. for Champion.[3]—JOHN EVENS & SON, Burton, Lincoln, for **Burton Melton 8th** (Vol. 38, p. 236), born Jan. 18, 1931, calved May 7, 1935; *s.* Saltfleet Cupbearer 23984, *d.* Burton Melton 2nd *by* Stapleford Fox 14903.

1233 II.—J. A. MARSDEN POPPLE, Daneshill, Stevenage, Herts., for **Beaconhill Dina 2nd** (Vol. 35, p. 359), born March 19, 1928, calved June 12, 1935, bred by Col. C. de Paravicini, Corby, Grantham; *s.* Anwick Victor 7th 19121, *d.* Beaconhill Dina *by* Cockerington Anderby 16282.

1230 III.—H. GORE BROWNE, Broombriggs, Woodhouse, Loughborough, for **Broombriggs Selina** (Vol. 35, p. 259), born April 5, 1928, calved Jan. 6, 1935; *s.* Saltfleet Waterloo 22442, *d.* Broombriggs Rummy *by* Stamford 16978.

1232 R.N.—THE EXORS. OF J. G. MCDOUGALL, Chippinghurst Manor, Cuddesdon, Oxon., for **Broombriggs Virtue.**

Class 165.—*Lincolnshire Red Shorthorn Cows, in-milk, born in or before* 1930, *showing the best milking properties.*

1240 I.—SCOTHERN DAIRY CO., Scothern Manor, Lincoln, for **Lobthorpe Princess** (Vol. 38, p. 271), born in Feb., 1929, calved May 6, 1935, bred by Col. C. de Paravicini, Corby, Grantham; *s.* Cockerington Anderby 16282, *d.* Beacon Hill Rahab *by* Tealby No. 313 14957.

1239 II.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Wratting Cherry** (Vol. 37, p. 312), born March 17, 1930, calved May 27, 1935; *s.* Ketteringham Milkman 19549, *d.* Bendish Cherry 14th *by* Burton Ruby King 2nd 14314.

1236 III.—JOHN EVENS & SON, Burton, Lincoln, for **Bracebridge Lady** (Vol. 35, p. 384), born Feb. 5, 1928, calved June 8, 1935, bred by C. E. Scorer, Bracebridge Heath, Lincoln; *s.* Burton Jew 4th 19205, *d.* Bracebridge No. 64 *by* Normanby Milkman 10098.

1243 R.N.—RUSSELL WOOD, Bendish House, Hitchin, for **Bendish Nancy 18th.**

Class 166.—*Lincolnshire Red Shorthorn Cows or Heifers, in-milk, born in or after* 1931, *showing the best milking properties.*[2]

1246 I.—JOHN EVENS & SON, Burton, Lincoln, for **Burton Nancy 25th** (Vol. 40, p. 258), born May 18, 1931, calved May 29, 1935; *s.* Burton Diligence 3rd 22802, *d.* Burton Nancy 21st *by* Burton Aim 6th 19199.

1247 II.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Wratting Milker 2nd** (Vol. 38, p. 299), born July 31, 1932, calved June 22, 1935; *s.* Burton Rose Boy 8th 23526, *d.* Wratting Milker *by* Burton Rose Boy 7th 20140.

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[1] Champion Silver Challenge Cup given through the Lincolnshire Red Shorthorn Association for the best Bull.

[2] Prizes given by the Lincolnshire Red Shorthorn Association.

[3] Champion Silver Challenge Cup given through the Lincolnshire Red Shorthorn Association for the best Cow or Heifer.

1250 III.—SCOTHERN DAIRY CO., Scothern Manor, Lincoln, for **Scothern Vixen 12th**, born Jan. 14, 1931, calved May 6, 1935, bred by B. G. Bowser, Nettleham Heath, Lincoln; *s.* Scothern Fascination 19776, *d.* Scothern Vixen 7th (Vol. 34, p. 228) *by* Scothern Fascination 19776.

1245 R.N.—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Dairymaid 69th.**

Class 167.—*Lincolnshire Red Shorthorn Heifers, born in* 1933.

1251 I.—W. DENNIS & SONS, LTD., Kirton, Boston, Lincs., for **Kirton Dossie** (Vol. 40, p. 244), born July 15; *s.* Broombriggs Victor 25775, *d.* Anwick No. 149 *by* Strubby Marshman 25th 22529.

Class 168.—*Lincolnshire Red Shorthorn Heifers, born in* 1934.

1253 I. & Champion.[1]—S. CECIL ARMITAGE, Lenton Fields, Nottingham, for **Lenton Violet** (Vol. 40, p. 192), born Jan. 21; *s.* Lenton Pawdy 26617, *d.* Cropwell Violet 9th *by* Cropwell Ajax 24454.

1254 II.—H. GORE BROWNE, Broombriggs, Woodhouse, Loughborough, for **Broombriggs Barbara**, born Jan. 20; *s.* Saltfleet Waterloo 22442, *d.* Broombriggs Selina (Vol. 35, p. 259).

1258 III.—THE EXORS. OF J. G. MCDOUGALL, Chippinghurst Manor, Cuddesdon, Oxon., for **Chippinghurst Rouge 1st**, born May 10, bred by J. G. McDougall; *s.* Anderby Dipper 25701, *d.* Melton Rouge 20th (Vol. 37, p. 307) *by* Kirmington Ascent 6th 20471.

1252 R.N.—HIS MAJESTY THE KING, Sandringham, Norfolk, for **Wolferton Tea Rose 17th.**

South Devons.

Classes 169 to 171.

[No Entries.]

Red Polls.

Class 172.—*Red Poll Bulls, born in or before* 1932.

1267 I. & Champion.[2]—STUART PAUL, Kirton Lodge, Ipswich, for **Brightwell Conqueror** 16017, born Jan. 23, 1931, bred by the late Rt. Hon. E. G. Pretyman, Orwell Park, Ipswich; *s.* Seven Springs Luck Stone 13923, *d.* 27506 Brightwell Constance *by* Shotley Drummer 11203.

1265 II.—MRS. R. M. FOOT, White Hill, Berkhamsted, for **White Hill D'ye Ken 16588**, born May 8, 1931; *s.* White Hill Cub Hunter 15166, *d.* 33536 Basildon Rosemary 2nd *by* Hanningfield Conductor 12646.

1263 III.—C. H. CRAEN, Gatwick Farm, Upper Gatton, Reigate, for **Abbeycombe Fencer** 15563, born Nov. 3, 1930, bred by J. G. Gray, Coombe Abbey, Coventry; *s.* Abbeycombe Drake 14747, *d.* 38725 Abbeycombe Catkin *by* Wissett Dad 13265.

1268 R.N.—STUART PAUL, for **Gresham Magnet 14904.**
H.C.—1270. C.—1264.

Class 173.—*Red Poll Bulls, born on or between January* 1 *and May* 31, 1933.

1274 I.—MRS. G. MEINERTZHAGEN, Theberton, Leiston, Suffolk for **Morston Hero 16828**, born Feb. 13, bred by A. T. Pratt, Morston Hall, Trimley, Ipswich; *s.* Basildon Hero 14416, *d.* 32948 Morston Lucy 4th *by* Necton Conductor 12083.

1271 II.—J. G. GRAY, Coombe Abbey, Coventry, for **Abbeycombe Royal Roseman 2nd** 16612, born Feb. 19; *s.* Marsden Mars 13501, *d.* 40819 Basildon Royal Rosie 8th *by* Basildon Regulator 14026.

1275 III.—STUART PAUL, Kirton Lodge, Ipswich, for **Kirton Drake 16789**, born Jan. 23; *s.* Abbeycombe Drake 14747, *d.* 42585 Yoxford Dora 1st *by* Yoxford Ronald 14398.

1273 R.N.—EDWARD HINCHLIFFE, Applegarth House, Ottringham, Hull, for **Ottringham Champion.**

Class 174.—*Red Poll Bulls, born on or between June* 1 *and December* 31, 1933.[3]

1280 I. & R.N. for Champion.[2]—LADY LODER, Leonardslee, Horsham, for **Leonardslee Bonnie Boy 17108**, born June 7; *s.* Leonardslee Paragon 16804, *d.* 40913 Bradenham Bonnie *by* Sporle Recorder 14321.

1281 II.—WALTER SCRIMGEOUR, Wissett Hall, Halesworth, Suffolk, for **Fersfield Red Fox 16th** 16725, born July 2, bred by S. E. Radford, Fersfield, Diss; *s.* Mickleover Red Fox 15049, *d.* 34380 Lowther Jerkin *by* Framlingham Chieftain 12290.

1276 III.—SIR WOODMAN BURBIDGE, BART., Cisswood, Lower Beeding, Horsham, for **Beeding Royalist 16628**, born Nov. 24; *s.* Knepp Strawberry 15775, *d.* 46490 Yoxford Rosie 2nd *by* Yoxford Challenger 14389.

1282 R.N.—OWEN H. SMITH, Langham, Oakham, for **Fersfield Red Fox 17th.**

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[1] Champion Silver Challenge Cup given through the Lincolnshire Red Shorthorn Association for the best Cow or Heifer.
[2] Champion Prize of £5 given by the Red Poll Cattle Society for the best Bull.
[3] Prizes given by the Red Poll Cattle Society.

Class 175.—*Red Poll Bulls, born in* 1934.

1284 I.—C. H. CHARN, Gatwick Farm, Upper Gatton, Reigate, for **Chipstead Founder**, born Jan. 1; *s.* Abbeycombe Fencer 15563, *d.* 35153 Ashmoor Pert *by* Ashmoor Socrates 12905.

1285 II.—LADY CHESHAM, Latimer, Chesham, for **Latimer Primrose League 17104**, born Feb. 9; *s.* Latimer Minstrel 15779, *d.* 36479 Sharnden Primula *by* Colworth Primrose League 12564.

1283 III.—LT.-COL. R. C. BATT, C.B.E., M.V.O., Gresham Hall, Norwich, for **Gresham Magneto 17047**, born Feb. 3; *s.* Lichfield Red Rover 14983, *d.* 43870 Gresham Mischief *by* Bredfield Darius 2nd 12942.

1288 IV.—J. G. GRAY, Coombe Abbey, Coventry, for **Abbeycombe Juniper 16927**, born Feb. 17; *s.* Abbeycombe Fabian 15561, *d.* 46500 Abbeycombe Gloria *by* Tittleshall Arravale 13952.

1289 R.N.—SIR GUY HAMBLING, BART., Rookery Park, Yoxford, for **Yoxford Royal 11th**.
H.C.—1293. C.—1286, 1287.

Class 176.—*Red Poll Cows, in-milk, born in or before* 1929.

1307 I. & Champion.[1]—LADY LODER, Leonardslee, Horsham, for **43518 Hyders Coral**, born Dec. 18, 1929, calved April 26, 1935, bred by Mrs. C. N. Dyer, Hyders, Crawley; *s.* Gresham Warrior 14142, *d.* 40371 Sporle Reflecting Coral *by* Necton Minister 13880.

1295 II.—HIS MAJESTY THE KING, Sandringham, for **32960 Necton Daffodil**, born Sept. 18, 1923, calved June 9, 1935, bred by Harvey Mason, Necton, Swaffham; *s.* Marham Armistice 11410, *d.* 26401 Necton Dolores *by* Shrewsbury 10489.

1305 III.—MRS. M. L. GRIFFITH, Little Hallingbury Park, Essex, for **37525 Grundisburgh Ruby**, born Sept. 30, 1926, calved April 24, 1935, bred by Lord Cranworth, Grundisburgh, Suffolk; *s.* Gresham Mainstay 13030, *d.* 30687 Assington Diamond *by* Melton Prosper 11740.

1309 R.N.—WALTER SCRIMGEOUR, Wissett Hall, Halesworth, for **Wissett Nonesuch**.
H.C.—1297. C.—1304.

Class 177.—*Red Poll Cows or Heifers, in-milk, born in* 1930, 1931 *or* 1932.[2]

1314 I.—C. H. CHARN, Gatwick Farm, Upper Gatton, Reigate, for **44519 Abbeycombe Fatsia**, born Feb. 20, 1930, calved June 15, 1935, bred by J. G. Gray, Coombe Abbey, Coventry; *s.* Abbeycombe Cockspur 14397, *d.* 34980 Upton Sally *by* Sudbourne Berryman 12843.

1319 II.—SIR GUY HAMBLING, BART., Rookery Park, Yoxford, Suffolk, for **50612 Yoxford Beryl 4th**, born April 30, 1932, calved June 11, 1935; *s.* Abbeycombe Drake 14747, *d.* 27962 Knepp Beryl *by* Harefield Bestman 10999.

1318 III.—MRS. M. L. GRIFFITH, Little Hallingbury Park, Essex, for **45360 Hallingbury Ruby**, born March 10, 1930, calved March 21, 1935; *s.* White Hill Hunter 14719, *d.* 37525 Grundisburgh Ruby *by* Gresham Mainstay 13030.

1313 R.N.—SIR WOODMAN BURBIDGE, BART., Cisswood, Lower Beeding, Horsham, for **Knepp Primula 3rd**.
H.C.—1315, 1327. C.—1316, 1317.

Class 178.—*Red Poll Heifers, born in* 1933.

1329 I. & R.N. for Champion.[1]—LT.-COL. R. C. BATT, C.B.E., M.V.O., Gresham Hall, Norwich, for **51463 Gresham Madeira 3rd**, born Feb. 25; *s.* Lichfield Red Rover 14983, *d.* 36400 Ridgeway Madeira *by* Drinkstone Monarch 12585.

1332 II.—J. G. GRAY, Coombe Abbey, Coventry, for **51223 Delamere Marque**, born Feb. 18, bred by W. G. Clegg, Abbey Wood, Delamere, Northwich; *s.* Seven Springs Quaker 15894, *d.* 45725 Marsden Marza *by* Marsden Mars 13501.

1331 III.—C. H. CHARN, Gatwick Farm, Upper Gatton, Reigate, for **Nashes Maud 12th 52068**, born Feb. 6, bred by Sherriff & Sons, Welwyn Garden, Herts.; *s.* White Hill Tally Ho 15521, *d.* 41951 Nashes Maud 4th *by* White Hill Artist 2nd 13973.

1336 R.N.—STUART PAUL, Kirton Lodge, Ipswich, for **Foxearth Bella 2nd**.
H.C.—1333. C.—1328.

Class 179.—*Red Poll Heifers, born in* 1934.

1347 I.—STUART PAUL, Kirton Lodge, Ipswich, for **53922 Kirton Ruralist**, born March 2; *s.* Gresham Magnet 14904, *d.* 39731 Kirton Rue *by* Bredfield Pedlar 2nd 13313.

1339 II.—HIS MAJESTY THE KING, Sandringham, for **54449 Royal Iris**, born Feb. 3; *s.* Hatton Faber 14151, *d.* 32960 Necton Daffodil *by* Marham Armistice 11410.

1340 III.—SIR WOODMAN BURBIDGE, BART., Cisswood, Lower Beeding, Horsham, for **52906 Beeding Eva**, born Jan. 7; *s.* Hyders Gauntlet Fire 16185, *d.* 46485 Yoxford Eva 3rd *by* Yoxford Challenger 14389.

1343 R.N.—SIR GUY HAMBLING, BART., Rookery Park, Yoxford, Suffolk, for **Yoxford Mavis 5th**.
H.C.—1346. C.—1338.

1275, 1325, 1347 Cup.[3]—STUART PAUL, for **Kirton Drake, Kirton Claret and Kirton Ruralist**.

1288, 1316, 1317, R.N. for Cup.[3]—J. G. GRAY, for **Abbeycombe Juniper, Abbeycombe Flora and Abbeycombe Heyday**.

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[1] Champion Prize of £5 given by the Red Poll Cattle Society for the best Cow or Heifer.

[2] Prizes given by the Red Poll Cattle Society.

[3] The "Henham" Silver Challenge Cup given through the Red Poll Cattle Society for the best group of one Bull and two Cows or Heifers, bred by Exhibitor.

Blue Albions.[1]

Class 180.—*Blue Albion Bulls, born in or before* 1933.

1350 I. & Champion.[2]—C. H. GOODWIN, Boro Fields, Walton-on-Trent, Burton-on-Trent, for **Snarestone Baron** 1947, born Aug. 8, 1930, bred by W. E. Glover, Snarestone, Burton-on-Trent; *s.* Snarestone Jester 1799, *d.* Snarestone Creole 10660 *by* Mountain Count 163.
1349 II.—W. E. GLOVER, The Shrubberies, Snarestone, Burton-on-Trent, for **Snarestone General** 2041, born April 23, 1933; *s.* Snarestone Jester 1799, *d.* Snarestone Duchess 9th 12370 *by* Barton Jude 2nd 1183.
1351 III.—CHARLES HENRY WEBSTER, Ivonbrook Farm, Grange Mill, Derby, for **Ivonbrook Guardsman** 2007, born Jan. 12, 1933; *s.* Winthorpe Major 1979, *d.* Ivonbrook Model 12736.

Class 181.—*Blue Albion Bulls, born in* 1934.

1352 I. & R.N. for Champion.[2]—JOHN BASSETT, Hill Top Farm, Ashover, Derbyshire, for **Asherblue Dairyman** 21051, born April 28; *s.* Mount Martinstown 1909, *d.* Asherblue Barton 12534 *by* Barton Alderman.
1357 II.—C. H. GOODWIN, Boro Fields, Walton-on-Trent, Burton-on-Trent, for **Magna Major 2nd**, born Jan. 26, bred by J. H. Davies, Rectory Farm, Appleby Magna, Burton-on-Trent; *s.* Magna Rob 2nd 1895, *d.* Magna Molly 2nd 11252 *by* Heather Rover 619.
1354 III.—T. H. CALDERBANK, The Hall, Stow Maries, Chelmsford, for **Stow Blue Boy**, born March 1; *s.* Walden Manners 2055, *d.* Stow Pearl 12448 *by* Broomhill Threshold 499.

1356 R.N.—W. E. GLOVER, The Shrubberies, Snarestone, Burton-on-Trent, for **Snarestone Ringer.**

Class 182.—*Blue Albion Cows or Heifers, in-milk, born in or before* 1932.

1359 I. & Champion.[3]—W. E. GLOVER, The Shrubberies, Snarestone, Burton-on-Trent, for **Mount Crocus 3rd** 12782, born Aug. 11, 1929, calved May 2, 1935, bred by T. H. Swire & Sons, Mount Farm, Norton-in-Hales, Market Drayton; *s.* Mount Fearless 1731, *d.* Mount Crocus 2nd 9598.
1358 II.—T. H. CALDERBANK, The Hall, Stow Maries, Chelmsford, for **Stow Doreen** 13270, born Jan. 6, 1932, calved May 1, 1935; *s.* Stow Whats Wanted 1969, *d.* Stow Countess 11522 *by* Broomhill Threshold 499.
1361 III.—C. H. GOODWIN, Boro Fields, Walton-on-Trent, Burton-on-Trent, for **Eileen 2nd of Crossfields** 12389, born in Aug. 1930, calved May 30, 1935.

1360 R.N.—W. E. GLOVER, for **Patience of Snarestone.**

Class 183.—*Blue Albion Heifers, born in* 1933.

1365 I.—JOHN BASSETT, Hill Top Farm, Ashover, Derbyshire, for **Asherblue Primrose** 12994, born April 10; *s.* Asherblue Clansman 1829, *d.* Asherblue Blossom 10026 *by* Nottil John 335.
1364 II.—JOHN BASSETT, for **Asherblue Margaret** 12990, born June 28; *s.* Asherblue Clansman 1829, *d.* Mount Margaret 121 *by* Mount Goalkeeper 1049.
1367 III.—CHARLES HENRY WEBSTER, Ivonbrook Farm, Grange Mill, Derby, for **Ivonbrook Poppy** 13112, born Jan. 11; *s.* Winthorpe Major 1979, *d.* Ivonbrook Tulip 12736.

1366 R.N.—C. H. GOODWIN, Boro Fields, Walton-on-Trent, Burton-on-Trent, for **Jean 2nd of Crossfields.**

Class 184.—*Blue Albion Heifers, born in* 1934.

1368 I. & R.N. for Champion.[3]—JOHN BASSETT, Hill Top Farm, Ashover, Derbyshire, for **Asherblue Tulip**, born Feb. 20; *s.* Mount Martinstown 1909, *d.* Asherblue Bella 2nd *by* Asherblue Clansman 1829.
1370 II.—CHARLES HENRY WEBSTER, Ivonbrook Farm, Grange Mill, Derby, for **Ivonbrook Daisy 2nd**, born June 15; *s.* Ivonbrook Emperor 2005, *d.* Ivonbrook Betty.
1369 III.—W. E. GLOVER, The Shrubberies, Snarestone, Burton-on-Trent, for **Promise of Snarestone**, born May 24; *s.* Snarestone Viking 1953.

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[1] £75 towards these Prizes were given by the Blue Albion Cattle Society.
[2] Perpetual Silver Challenge Cup given by the Blue Albion Cattle Society for the best Bull.
[3] Perpetual Silver Challenge Cup given by the Blue Albion Cattle Society for the bes Cow or Heifer.

British Friesians.

The letters P.I. after the name of an animal indicate that such animal is of pure imported Friesian (Holland) or South African blood.
Unless otherwise stated the numbers refer to the British Friesian Herd Book.

Class 185.—*British Friesian Bulls, born in or before* 1932.[1]

1373 I., £20.—HODGE BROS., Wyddial Bury, Buntingford, for **Terling Matrix 41339**, born Jan. 2, 1932, bred by Lord Rayleigh, The Bury, Hatfield Peverel; *s.* Terling (imp. 1922) Marthus 21533, *d.* Terling Trix 14th 110764 *by* Dunninald Haeayemairschaap 7699 P.I.

1377 II., £15.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Lingman** 39149 P.I., born April 24, 1931; *s.* Moordale Ambassador 31555 P.I., *d.* Dennistoun Lady Colantha 125862 *by* Bladen Lord Verwachting 13283 P.I.

1371 III., £10.—F. W. GILBERT, The Manor, Chellaston, Derby, for **Glen Bushranger 2nd** 40509, born May 10, 1932, bred by Arthur Allen, Chesterblade, Shepton Mallet; *s.* Glen Bruce 37381, *d.* Bowerchalke Bud 50892 *by* Glen Taurus 9755.

1374 R.N.—MALCOLM MCILCHERE, Cartside Farm, Thorntonhall, Lanarkshire, for **Kintyre Thorn.**

Class 186.—*British Friesian Bulls, born on or between January* 1 *and June* 30, 1933.

1378 I., Champion[2] & Champion.[3]—G. B. RADCLIFFE, Pool Bank, Tarvin, Chester, for **Saracens General 42889** P.I., born Feb. 4, bred by J. R. Upson, Rush Court, Wallingford; *s.* Saracens Meibloem Don 38073 P.I., *d.* Henbury Pretty Polly 105860 P.I. *by* Wychnor Frits 7215 P.I.

1379 II.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Nevis 42339**, born Feb. 14; *s.* Bute Lygon 32409 P.I., *d.* Drum Laverick 126062 *by* Douneside Masterpiece 19835.

Class 187.—*British Friesian Bulls, born on or between July* 1 *and December* 31, 1933.

1384 I. & R.N. for Champion.[3]—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Hatsumer Neptune 42331** P.I., born Sept. 26; *s.* Saracens Dennis 38055 P.I., *d.* Herrington Hatsumer 117196 P.I. *by* Wychnor Jan 24645 P.I.

1381 II.—D. A. MACLENNAN, Balmachree, Inverness, for **Balmachree Norman 41559**, born Nov. 20; *s.* Balmachree Hero 33767, *d.* Dell Duchess 155538 *by* Commieston Harry 35509.

1380 III.—ERNEST B. HALL, Hales Hall, Market Drayton, for **Dennistoun Lord Tratloe** 41971, born Aug. 23, bred by Mrs. McKendrick, Craigends, Dennistoun; *s.* Moordale Ambassador 31555 P.I., *d.* Dennistoun Maggie Rose 70400 *by* Knebworth Imperator 10081.

1385 R.N.—ALBERT WEIGHTMAN, for **Herrington Nokoma.**

Class 188.—*British Friesian Bulls, born on or between January* 1 *and June* 30, 1934.

1394 I., R.N. for Champion,[2] R.N. for Champion,[3] & Champion.[4]—THE TRUSTEES OF SIR ALASDAIR W. MACROBERT, BART., Douneside, Tarland, Aberdeenshire, for **Douneside Benachie 43835**, born Feb. 21; *s.* Lochlands Rijper 29237 P.I., *d.* Douneside Becula 6th 145896 *by* Douneside Masterpiece 19835.

1388 II.—F. W. GILBERT, The Manor, Chellaston, Derby, for **Oulton Glossy Boy 44517**, born April 15, bred by A. G. Mobbs, Swavesey Lodge, Oulton, Lowestoft; *s.* Terling Marksman 39787, *d.* Oulton Glossy 140164 *by* Oulton (imp. 1922) Officer 21127.

1393 III.—THE TRUSTEES OF SIR ALASDAIR W. MACROBERT, BART., for **Douneside Apostle 43833**, born Feb. 20; *s.* Lochlands Rijper 29237 P.I., *d.* Douneside Albert's Minnie 145890 *by* Douneside Masterpiece 19835.

1386 R.N.—G. J. CADDEY, Manor House, Egham, Surrey, for **Lawford Norman.**

Class 189.—*British Friesian Bulls, born on or between July* 1 *and December* 31, 1934.

1407 I.—BERTRAM PARKINSON, Creskeld Hall, Arthington, Leeds, for **Creskeld Pel Beatty 2nd 43687**, born July 23; *s.* Creskeld Knierke Beatty 35565 P.I., *d.* Golf Dairymaid 2nd 137142 *by* Golf Marden 32791.

1401 II.—CLIFFORD W. H. GLOSSOP, M.P., The Lund Dairies, Bramwith Hall, Doncaster, for **Terling Torment 44989**, born July 18, bred by Lord Rayleigh, The Bury, Hatfield Peverel; *s.* Terling Huntsman 36607, *d.* Terling Torch 43rd 121888 *by* Terling (imp. 1922) Marthus 21533.

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[1] Prizes given by the British Friesian Cattle Society.
[2] Champion Prize of £10 given by the British Friesian Cattle Society for the best Bull.
[3] The "Mayford" Silver Challenge Trophy given through the British Friesian Cattle Society for the best Bull.
[4] The "Douneside" Silver Challenge Cup given through the British Friesian Cattle Society for the best Bull, bred by Exhibitor.

1399 III.—A. J. CREED, Goldicote House, Stratford-on-Avon, for **Chellaston Burika** 43529 P.I., born July 1, bred by F. W. Gilbert, The Manor, Chellaston, Derby ; *s.* Hales Burika 35865 P.I., *d.* Tyneside Joukje 111114 P.I. *by* Lochlands Rijpmas Hollander 20773 P.I.

1406 R.N.—THE TRUSTEES OF SIR ALASDAIR W. MACROBERT, BART., Douneside, Tarland, Aberdeenshire, for **Douneside Triumph.**

Class 190.—*British Friesian Cows, in-calf.*[1]

1415 I.—T. E. GLADSTONE, Margery Flatts, Lanchester, Co. Durham, for **Dignit Logic** 135916, born June 11, 1929 ; *s.* Westonhall Johan 3rd 33625, *d.* Dignit Lonely Lass 80992 *by* Herrington Bradbury 17343.

1417 II.—THE TRUSTEES OF SIR ALASDAIR W. MACROBERT, BART, Douneside, Tarland, Aberdeenshire, for **Douneside Becula 5th 145894,** born June 4, 1930 ; *s.* Douneside Masterpiece 19835, *d.* Douneside Becula 70586 *by* Douneside Hatsumerschaap 13719 P.I.

1412 III.—A. J. CREED, Goldicote House, Stratford-on-Avon, for **Hawthorn Katja 117076,** born May 6, 1927, bred by William Turner, Offerton, Hindlip ; *s.* Brampton Hilko 24971, *d.* Hawthorn Harebell 82768 *by* Hedges Anema 20293.

1421 IV.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Jeltje 137722,** born Sept. 10, 1929 ; *s.* Wychnor Jan 24645 P.I., *d.* Herrington Gracie 105906 *by* Herrington Ynte's Editor 26037.

1416 R.N.—T. E. GLADSTONE, for **Dignit Lucky Lass.**
H.C.—1419.

Class 191.—*British Friesian Cows, in-milk, born in or before* 1929, *having yielded a minimum of* 8,000 *lb. of milk during a lactation period of* 315 *days.*[1]

1430 I., £20 & Champion.[2]—LORD RAYLEIGH, The Bury, Hatfield Peverel, Chelmsford, for **Terling Breeze 34th 141922,** born Feb. 21, 1929, calved May 23, 1935 ; *s.* Terling Collona's Lad 30001 P.I., *d.* Terling Breeze 22nd 99208 *by* Terling (imp. 1922) Marthus 21533.

1437 II., £15.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Image 127872,** born Sept. 19, 1928, calved June 8, 1935 ; *s.* Wychnor Jan 24645 P.I., *d.* Pennybridge Pearl 48052 *by* Wigginton Rock 10835.

1424 III., £10.—ARTHUR BARBER, Carlton Hall Farm, Worksop, for **Whaley Lavender** 88714, born Nov. 27, 1924, calved June 1, 1935, bred by W. Hunt, Whaley, Mansfield ; *s.* Hedges Vic Baron 11851, *d.* Rosehill Queenie 2nd 41694 *by* Gold Botermijn 2nd 6327 P.I.

1429 IV., £4.—G. B. RADCLIFFE, Pool Bank, Tarvin, Chester, for **Tarvin Sunshine 141876,** born March 23, 1929, calved April 13, 1935 ; *s.* Tarvin (imp. 1922) Mazeppa 21507, *d.* Tarvin Kathleen 57254 *by* Wigginton Johan 7165 P.I.

1433 R.N.—LORD RAYLEIGH, for **Terling Thyme 17th.**
H.C.—1432, 1434, 1436.

Class 192.—*British Friesian Cows, in-milk, born in* 1930 *or* 1931, *having yielded a minimum of* 6,500 *lb. of milk during a lactation period of* 315 *days.*[1]

1442 I., £20.—WILLIAM TURNER, Offerton, Hindlip, Worcester, for **Hawthorn Ornament** 157342, born Sept. 10, 1931, calved May 31, 1935 ; *s.* Hache Frobisher 34333 P.I., *d.* Lyppard Princess Beatrice 84668 *by* Brooklands Prince Bodega 13385.

1439 II., £15.—T. E. GLADSTONE, Margery Flatts, Lanchester, Co. Durham, for **Dignit Diana** 155652, born Sept. 30, 1931, calved June 17, 1935 ; *s.* Dignit Glosster 37239, *d.* Dignit Diagram 135914 *by* Westonhall Johan 3rd 33625.

Class 193.—*British Friesian Heifers, in-milk to first calving, born on or after January* 1, 1932.[1]

1447 I., & R.N. for Champion.[2]—WILLIAM TURNER, Offerton, Hindlip, Worcester, for **Hawthorn Portia 168144,** born July 4, 1932, calved Feb. 15, 1935 ; *s.* Hache Frobisher 34333 P.I., *d.* Hedon Dolly 82938 *by* Lochlands Roland 23527.

1452 II.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Melody 168332,** born Dec. 19, 1932, calved May 28, 1935 ; *s.* Herrington Initialad 34407, *d.* Golf Birthday Sands 127280 *by* Northdean Hollander 2nd 21079 P.I.

1448 III.—W. CURTIS & SON, Berwick Manor, Rainham, Essex, for **Abingworth Helen** 163100, born March 23, 1932, calved May 11, 1935, bred by Capt. F. E. Stobart, Abingworth, Pulborough, Sussex ; *s.* Terling Matador 31987, *d.* Abingworth Dainty 123010 *by* Northdean Captain 23835.

1445 R.N.—T. E. GLADSTONE, Margery Flatts, Lanchester, Co. Durham, for **Dignit Lass.**
H.C.—1444, 1446, 1449, 1450.

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[1] Prizes, except Fourth, given by the British Friesian Cattle Society.
[2] Champion Prize of £10 given by the British Friesian Cattle Society for the best Cow or Heifer.

Class 194.—*British Friesian Heifers, born on or between January* 1 *and June* 30, 1933.

1454 I.—G. B. RADCLIFFE, Pool Bank, Tarvin, Chester, for **Tarvin Apple Blossom 183732**, born March 1; *s.* Tarvin Janke's Mairschaap 33525 P.I., *d.* Tarvin Sweetbriar 141880 *by* Tarvin (imp. 1922) Mazeppa 21507.

1455 II.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Narcissi 179296**, born March 9; *s.* Herrington Initialad 34407, *d.* Chellaston Evelyn 134848 *by* Thurston Karel 3rd 32005 P.I.

1456 III.—ALBERT WEIGHTMAN, for **Herrington Naressa 179298**, born March 16; *s.* Herrington Initialad 34407, *d.* Herrington Ism 127892 *by* Herrington Grandee 31189.

1453 R.N.—F. W. GILBERT, The Manor, Chellaston, Derby, for **Chellaston Dotterell.**

Class 195.—*British Friesian Heifers, born on or between July* 1 *and December* 31, 1933.

1458 I.—W. CURTIS & SON, Berwick Manor, Rainham, Essex, for **Barwyke Zonda Signorinetta 174788**, born July 7; *s.* Gilston Zonda's Lodewijk 34267 P.I., *d.* Gilston Ceres Signorinetta 3rd 116374 *by* Gilston Ceres 9731.

1460 II.—THE TRUSTEES OF SIR ALASDAIR W. MACROBERT, BART., Douneside, Tarland, Aberdeenshire, for **Douneside Laura 177402**, born Oct. 3; *s.* Douneside Benefactor 3rd 38831, *d.* Douneside Lascella 155744 *by* Lochlands Rijper 29237 P.I.

1461 III.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Noranay 179318**, born Sept. 16; *s.* Herrington Initialad 34407, *d.* Herrington Hogmanay 117212 *by* Wychnor Jan 24645 P.I.

1462 R.N.—ALBERT WEIGHTMAN, for **Herrington Norma.**
H.C.—1457, 1459.

Class 196.—*British Friesian Heifers, born on or between January* 1 *and June* 30, 1934.[1]

1469 I.—G. B. RADCLIFFE, Pool Bank, Tarvin, Chester, for **Tarvin Unison 2nd 194870**, born Jan. 14; *s.* Tarvin Janke's Mairschaap 33525 P.I., *d.* Tarvin Unison 161892 *by* Tarvin (imp. 1922) Mazeppa 21507.

1470 II.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Olive 190270**, born Jan. 4; *s.* Saracens Dennis 38055 P.I., *d.* Abberton Mayflower 78054 *by* Abberton Hero 19139.

1466 III.—THE TRUSTEES OF SIR ALASDAIR W. MACROBERT, BART., Douneside, Tarland, Aberdeenshire, for **Douneside Petunia 188474**, born Feb. 19; *s.* Dennistoun Jeringa 38811, *d.* Douneside Primula 2nd 155754 *by* Douneside Masterpiece 19835.

1467 R.N.—G. B. RADCLIFFE, for **Tarvin Akke.**
H.C.—1463, 1464, 1468, 1471.

Class 197.—*British Friesian Heifers, born on or between July* 1 *and December* 31, 1934.[1]

1475 I.—THE TRUSTEES OF SIR ALASDAIR W. MACROBERT, BART., Douneside, Tarland, Aberdeenshire, for **Douneside Elma 2nd 188454**, born July 8; *s.* Lochlands Rijper 29237 P.I., *d.* Douneside Eva 103996 *by* Hache Apollo 22925 P.I.

1477 II.—ALBERT WEIGHTMAN, Middle Herrington Farm, Sunderland, for **Herrington Hatsumer Oblige 190260 P.I.**, born Sept. 4; *s.* Saracens Dennis 38055 P.I., *d.* Herrington Hatsumer's Janet 137716 P.I. *by* Wychnor Jan 24645 P.I.

1472 III.—JOHN CHRISTISON, Crossveggate, Milngavie, for **Crossveggate Dairymaid 187914**, born July 14; *s.* Clifford-chambers Iliad 40217, *d.* Crossveggate Beatess 185636 *by* Glentanar Beatus 28629.

1476 R.N.—J. R. UPSON, Rush Court, Wallingford, for **Saracens Melbloem 4th.**
H.C.—1478.

1454, 1468, 1469 **Gold Medal**[2] **& Trophy.**[3]—G. B. RADCLIFFE, for **Tarvin Apple Blossom, Tarvin Tess 2nd and Tarvin Unison 2nd.**

1419, 1442, 1447 **R.N. for Gold Medal.**[2]—WILLIAM TURNER, for **Hawthorn Norma, Hawthorn Ornament and Hawthorn Portia.**

1394, 1466, 1475 **R.N. for Trophy.**[3]—THE TRUSTEES OF SIR ALASDAIR W. MACROBERT, BART., for **Douneside Benachie, Douneside Petunia and Douneside Elma 2nd.**

Specials.[4]—I., £8, ALBERT WEIGHTMAN; II., £5, T. E. GLADSTONE.

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[1] Prizes, except Fourth, given by the British Friesian Cattle Society.

[2] Gold Medal given by the British Friesian Cattle Society for the best group of three Cows or Heifers.

[3] Perpetual Bronze Challenge Trophy given by the Friesland Cattle Breeders' Association of South Africa for the best group of three British Friesians, bred by Exhibitor.

[4] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the British Friesian Classes.

Ayrshires.

Class 198.—*Ayrshire Bulls, born before May* 1, 1933.

1482 I.—R. M. REID, The Glen Farm, Falkirk, for **Lessnessock Humanity 32263**, born Jan. 8, 1932, bred by A. W. Montgomerie, Lessnessock, Ochiltree; *s.* Lessnessock Sunny Jim 28437, *d.* Lessnessock Hughina 6th 1815 *by* Lessnessock Newmarket 23947.

1481 II.—LESLIE K. OSMOND, Netherwood Dairy Farm, Bradley, Grimsby, for **Auchenbrain Display 32429**, born Dec. 29, 1931, bred by David Wallace, Auchenbrain, Mauchline, Ayrshire; *s.* Lyonston Douglas 25768, *d.* Auchenbrain Dandy 15th 11832 *by* Rigg Jupiter 19483.

1479 III.—G. W. GREENSHIELDS, Clover Top, North Grindon, Sunderland, for **Laigh Tarbeg Night Patrol 33094**, born Jan. 10, 1932, bred by George Connell, Laigh Tarbeg, Ochiltree; *s.* Laigh Tarbeg Lucky Star 30057, *d.* Laigh Tarbeg Dark Girl 2nd 22139 *by* Lessnessock Farmer 26334.

1480 R.N.—JOHN LOGAN, Beauchamps, Wyddial, Buntingford, for **Beauchamps Bursary.**

Class 199.—*Ayrshire Bulls, born on or after May* 1, 1933.

1486 I.—ESHOTT PEDIGREE STOCK FARMS, Felton, Northumberland, for **Lessnessock Naphtha 34514**, born Aug. 24, 1933, bred by A. W. Montgomerie, Lessnessock, Ochiltree; *s.* Lessnessock Sunny Jim 28457, *d.* Picken's Nannie 3689 *by* Netherton Mazeppa 17227.

1491 II.—A. W. MONTGOMERIE, Westburn Farm, Cambuslang, for **Barboigh Radio 35328**, born Jan. 15, 1934, bred by Alexr. Watson, Barboigh, Mauchline; *s.* Lessnessock Ranger 30378, *d.* Barboigh Lofty 7th 24708 *by* Hill Speculation 26908.

1490 III.—JAMES HOWIE & SONS, Muirside, Dumfries, for **Grange Capture 35064**, born Feb. 11, 1934, bred by John Slater, Grange, Kirkcudbright; *s.* Howie's Rich and Rare 25901, *d.* Grange Tibbie 15th 26093 *by* Grange Eclipse 27690.

1485 R.N.—JAMES A. C. DAVIES, Middle Brunton, Gosforth, Newcastle-on-Tyne, for **Lessnessock Bitumen.**

H.C.—1488. C.—1484.

Class 200a.—*Ayrshire Cows, in-milk, born on or before May* 1, 1932.

1502 I., Champion [1] & Champion.[2]—JOHN N. DRUMMOND, Bargower, Hurlford, Ayrshire, for **Bargower Princess 10th 24663**, born Jan. 13, 1929, calved June 23, 1935; *s.* Bargower Brigadier 28441, *d.* Bargower Princess 7th 7640 *by* Riggfoot Paymaster 23854.

1506 II.—TREVOR GREENSHIELDS, Over-the-Hill, Houghton-le-Spring, Co. Durham, for **Craigraploch Cucumber 5th 31407**, born March 10, 1930, calved June 12, 1935, bred by George Dunlop, Craigraploch, Castle Douglas; *s.* Meikle Knox Premier 25695, *d.* Craigraploch Cucumber 4th 7164 *by* Craigraploch Moneymusk 25050.

1514 III. & R.N. for Champion.[1]—A. & A. KIRKPATRICK, Barr, Sanquhar, for **Bar Negress 29574**, born Dec. 11, 1929, calved June 26, 1935; *s.* Lyonston Broon Bun 28367, *d.* Barr Juanita 7206 *by* Sandhill Flashlight 21331.

1507 IV.—J. R. P. HEDLEY, Southcote Grange Farm, Reading, for **Eshott Brown Lady 32475**, born Nov. 3, 1929, calved June 15, 1935, bred by F. H. Sanderson, Eshott, Felton, Northumberland; *s.* Garclaugh Juggler 26157, *d.* Garclaugh Brown Lady 10th 11037 *by* Netherhall Topmost 18732.

1498 V.—ALEXANDER COCHRANE, Nether Craig, Kilmarnock, for **Lesserlinn Thrill 2nd 30522**, born April 6, 1930, calved June 16, 1935, bred by Thomas B. McGregor, Lesserlinn, Lanark; *s.* Howie's Topmost 26276, *d.* Lesserlinn Thora 2nd 96321 *by* Relief Viceroy 20638.

1504 R.N.—WILLIAM L. FERGUSON, East Cairnwell, Stranraer, for **Cairnwell Brownie 2nd.**

H.C.—1518, 1525. C.—1501, 1521.

Class 200b.—*Ayrshire Cows, in-calf, born on or before May* 1, 1932.

1513 I. & R.N. for Champion.[2]—JAMES HOWIE & SONS, Muirside, Dumfries, for **Howie's Dairy Lass 3rd 44126**, born Sept. 27, 1931; *s.* Howie's Orange Pip 29892, *d.* Howie's Dairy Lass 17094 *by* Millantae Better Still 25796.

1508 II.—J. R. P. HEDLEY, Southcote Grange Farm, Reading, for **Hartburn Rena 28539**, born Feb. 25, 1929, bred by T. Slater, Hartburn, Kirkcudbright; *s.* Hartburn Monarch 27830, *d.* Hartburn Lintie 93451 *by* Beuchan Gold Dust 15049.

1510 III.—A. B. HOWIE, Eshott Brocks, Felton, Morpeth, for **Bargower Bellflower 5th 31749**, born April 24, 1930, bred by John N. Drummond, Bargower, Hurlford; *s.* Riggfoot Paymaster 23854, *d.* Bargower Bellflower 97389 *by* Auchenbrain Rupert 18469.

1492 IV.—WILLIAM C. BLAIR, Dykehead Farm, Carmunnock, Lanark, for **Aitkenbrae Young Nannie 3rd 5360**, born June 30, 1925, bred by the late Thos. C. Lindsay, Aitkenbrae, Monkton, Ayrshire; *s.* Aitkenbrae Supreme 19552, *d.* Aitkenbrae Young Nannie 67950 *by* Aitkenbrae Everest 16012.

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[1] The "Oldner" Silver Challenge Cup given through the Ayrshire Cattle Herd Book Society for the best Cow or Heifer.

[2] The "Cowhill" Silver Challenge Cup given through the Ayrshire Cattle Herd Book Society for the best Ayrshire.

1522 V.—R. SILLARS & SON, Ickham Court, Canterbury, for **Ickham Bessie 14th 49683**, born Dec. 3, 1931; *s.* Ickham Foundation 27011, *d.* Ickham Stylish Daisy 19894 *by* Greenan Masterpiece 25328.

1494 R.N.—JOHN CLARK, Dunrod Farm, Inverkip, for **Dunrod Jessica 3rd.**
H.C.—1503, 1505, 1520, 1524. C.—1493, 1509, 1519, 1523.

Class 201a.—*Ayrshire Heifers, in-milk, born after May* 1, 1932, *and before May* 1, 1933.[1]

1527 I.—ALEXANDER COCHRANE, Nether Craig, Kilmarnock, for **Muirlaught Wilmal 50661**, born Oct. 20, 1932, calved June 13, 1935, bred by James Chalmers, Muirlaught, Saltcoats; *s.* Muirlaught Prince 26958, *d.* Muirlaught Betsy 2nd 23762 *by* Muirlaught Dan 23091.

1540 II.—A. W. MONTGOMERIE, Westburn Farm, Cambuslang, Glasgow, for **Lessnessock Fiona 54486**, born Sept. 7, 1932, calved June 22, 1935; *s.* South Craig Winalot 30014, *d.* Lessnessock Favourite 4th 23616 *by* Auchenbrain Yeoman 22785.

1536 III.—A. & A. KIRKPATRICK, Barr, Sanquhar, for **Barr Queenie 53709**, born July 7, 1932, calved June 30, 1935; *s.* Barr Here Goes 24536, *d.* Barr Hetty 94806 *by* Drumsuie Gaiety 13250.

Class 201b.—*Ayrshire Heifers, in-calf, born after May* 1, 1932, *and before May* 1, 1933.[1]

1545 I.—WYNDHAM T. VINT, Thorn Cottage, Wroot, Doncaster, for **Millantae Gipsy Girl 53037**, born Jan. 13, 1933, bred by John Johnstone, Millantae, Lockerbie; *s.* Millantae Masterprint 32175, *d.* Millantae Meg Merriless 29600 *by* Rowallan Minto 26190.

1539 II.—A. W. MONTGOMERIE, Westburn Farm, Cambuslang, Glasgow, for **Lessnessock Cora Linn 2nd 54483**, born Nov. 9, 1932; *s.* South Craig Broon Bun 29982, *d.* Lessnessock Cora Linn 29544 *by* Holehouse Investment 28500.

1543 III.—R. SILLARS & SON, Ickham Court, Canterbury, for **Ickham Carol 7th 49692**, born Aug. 14, 1932; *s.* Ickham Foundation 27011, *d.* Ickham Carol 3rd 19865 *by* Greenan Masterpiece 25328.

1531 IV.—ROBERT DALZIEL, Rue, Auldgirth, for **Rue Gwen**, born Nov. 24, 1932; *s.* Hillhouse Majestic 31248, *d.* Rue Ella 12981 *by* Auchendrane Winston 23318.

1534 R.N.—TREVOR GREENSHIELDS, Over-the-Hill, Houghton-le-Spring, for **Over the Hill Winkipop.**
H.C.—1532, 1537. C.—1526, 1541.

Class 202.—*Ayrshire Heifers, born on or after May* 1, 1933.

1555 I.—A. W. MONTGOMERIE, Westburn Farm, Cambuslang, Glasgow, for **Westburn Miss Marjory**, born Dec. 20, 1933, bred by Wilson & Montgomerie, Westburn, Cambuslang; *s.* Bargenoch Blue Ribbon 31923, *d.* Mosside Miss Marjory 35097 *by* Mosside First Aid 27740.

1557 II.—WYNDHAM T. VINT, Thorn Cottage, Wroot, Doncaster, for **Whitehill Della 61865**, born Dec. 27, 1933, bred by John Smith, Whitehill, Ochiltree, Ayrshire; *s.* Willoxton Measure 31542, *d.* Whitehill Ena 2nd 38251 *by* South Craig Specialist 28155.

1551 III.—A. B. HOWIE, Eshott Brocks, Felton, Morpeth, for **Brocks Jenny 4th 57852**, born May 24, 1933; *s.* Howie's Follow After 29887, *d.* Brocks Jenny 2nd 19497 *by* Douglas Hall Speculation 18566.

1553 R.N.—JOHN LOGAN, Beauchamps, Wyddial, Buntingford, for **Beauchamps Azure.**
H.C.—1547, 1549. C.—1548, 1552.

Specials.[2]—I., £8, ESHOTT PEDIGREE STOCK FARMS; II., £5, & III., £3, divided between A. B. HOWIE and TREVOR GREENSHIELDS.

Guernseys.

N.B.—Unless otherwise stated the numbers refer to the English Guernsey Herd Book.

Class 203.—*Guernsey Bulls, born in or before* 1932.

1560 I., **Champion**[3] **& Champion.**[4]—W. DUNKELS, Fernhill Park, Windsor Forest, for **Fernhill Robert 5th 7795**, fawn and white, born April 28, 1929; *s.* Hindhead Robert 6th 5847, *d.* 14281 Downe Fleur de Vimiera *by* Valentine's Honour of the Passee 3826.

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[1] Prizes given by the Ayrshire Cattle Herd Book Society.

[2] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the Ayrshire Classes.

[3] Champion Prize of £5 given by the English Guernsey Cattle Society for the best Bull.

[4] The "Calehill" Silver Challenge Cup given by the English Guernsey Cattle Society for the best Bull.

1559 II.—CAPT. COSMO DOUGLAS, Hazelby, Newbury, for **Medora's Boy** 7853, fawn, born May 20, 1929, bred by E. F. J. Torode, Castel, Guernsey; *s.* Dairyman 5th des Valles 5462 P.S., *d.* 22892 P.S. Medora of La Houguette *by* Governor of Myrtle Place 5th 5445.
1562 III.—DAME E. LOCKE KING, Brooklands, Weybridge, for **Shiwa Cherie's Quickly Lad** 9511, fawn and white, born May 1, 1932; *s.* Shiwa Primrose Lad's Quickly 7519, *d.* 26058 Ivy's Cherie *by* Honoria's Sequel Slogan 4845 P.S.

1558 R.N.—MRS. JOAN K. BATESON, Lucas Green Manor, West End, Chobham, Surrey, for **Athene's Lad.**
H.C.—1564. C.—1563.

Class 204.—*Guernsey Bulls, born in* 1933.

1565 I., R.N. for Champion[1] & R.N. for Champion.[2]—W. DUNKELS, Fernhill Park, Windsor Forest, for **Bealings Kismet** 10022, fawn and white, born April 15, bred by Mrs. E. Howe, Bealings, Suffolk; *s.* Benhall Vice President 7959, *d.* 19529 Bealings Rose 7th *by* Raymond of the Carteret 2nd 3783.
1566 II.—ERIC H. ROSE, Leweston Manor, Sherborne, Dorset, for **Leweston Rose Lad 6th** 10529, fawn and white, born July 3; *s.* Leweston Rose Lad 7790, *d.* 29320 Lady Easter of La Rue *by* Sam of Le Fort 4409 P.S.

1567 R.N.—CAPT. FRANK SCHWAB, Kingfield, Fenton, Carlisle, for **Kingfield Slogan of Vimiera.**

Class 205.—*Guernsey Bulls, born in* 1934.

1576 I.—MRS. J. SUTCLIFFE PYMAN, Norsebury, Sutton Scotney, Hants., for **Fernhill Robert 11th** 10744, fawn and little white, born May 3, bred by W. Dunkels, Fernhill Park, Windsor Forest; *s.* Fernhill Robert 5th 7795, *d.* 18813 Fernhill Rose *by* Murrell Desmond 4263.
1577 II.—ERIC H. ROSE, Leweston Manor, Sherborne, Dorset, for **Leweston Golden Sequel 2nd** 11193, fawn and white, born March 17; *s.* Golden Tip's Sequel 2nd 8168, *d.* 16953 Rosey of Goodnestone 11th *by* Slogan de Bon Espoir 4317.
1579 III.—CAPT. L. REGINALD WAUD, Bradley Court, Chieveley, Newbury, for **Bradley Maggie 3rd's Slogan** 10943, fawn and white, born Aug. 4; *s.* Bradley Miss Maggie's Slogan 8800, *d.* 39396 Bradley Maggie 3rd *by* Firebrand of Marsh Close 8088.

1570 R.N.—CAPT. COSMO DOUGLAS, Hazelby, Newbury, for **Rosie's Souvenir de Vimiera.**
H.C.—1578. C.—1569.

Class 206.—*Guernsey Cows, in-milk, born in or before* 1930.

1583 I., Champion[3] & Champion.[4]—W. DUNKELS, Fernhill Park, Windsor Forest, for 28077 **Fernhill Rose 2nd,** fawn and white, born March 28, 1928, calved April 24, 1935; *s.* Hindhead Robert 6th 5847, *d.* 18813 Fernhill Rose *by* Murrell Desmond 4263.
1589 II.—CARL HOLMES, Clover Top Farm, Codicote, Hitchin, for 32102 **Dairy Queen of Clover Top,** fawn and white, born Nov. 3, 1929, calved March 27, 1935; *s.* Victor of Les Grantes 5813, *d.* 29544 Dairy Nellie's Queen *by* Charmantes Loyal 4735 P.S.
1591 III.—CARL HOLMES, for 31439 **May Rose of Clover Top,** fawn and white, born Aug. 2, 1929, calved April 23, 1935; *s.* May Rose Cherub of the Spurs 7729, *d.* 29547 Princess of Less Rues Frairies *by* Chieftain of the Glen 3959 P.S.

1581 R.N.—CAPT. COSMO DOUGLAS, Hazelby, Newbury, for **Hazelby Sunshine.**
H.C.—1586, 1593. C.—1590.

Class 207.—*Guernsey Cows or Heifers, in-milk, born in* 1931 *or* 1932.[5]

1598 I.—W. DUNKELS, Fernhill Park, Windsor Forest, for 35901 **Fernhill Rose 5th,** fawn and white, born April 20, 1931, calved May 2, 1935; *s.* Lavender's Slogan of La Hougue 7839, *d.* 28077 Fernhill Rose 2nd *by* Hindhead Robert 6th 5847.
1602 II.—CARL HOLMES, Clover Top Farm, Codicote, Hitchin, for 38484 **Rosey of Goodnestone 62nd,** fawn and white, born Feb. 1, 1932, calved June 23, 1935, bred by Lord Fitzwalter, Goodnestone Park, Canterbury; *s.* Rosey's Slogan 3rd of Goodnestone 7774, *d.* 31844 Rosey of Goodnestone 49th *by* Honoria's Advocate 5286.
1609 III.—MRS. YORKE, Peter's Farm, Lacock, Chippenham, for 38137 **Peter's Jennette,** fawn and white, born Dec. 28, 1931, calved June 10, 1935; *s.* Slogan of Woodlands 8056, *d.* 31900 Vern Jeanette's Fancy *by* Polly's Fancy of Grand Pré 5198 P.S.
1596 IV.—CAPT. COSMO DOUGLAS, Hazelby, Newbury, for 35908 **Hazelby Honoria,** fawn and white, born May 4, 1931, calved June 10, 1935; *s.* Candie's Queen's Fancy 7347, *d.* 25803 Princess 2nd of Chute Standen *by* Clatford Maitre du Moulin 5466.
1599 R.N.—H. A. Y. DYSON, Dalton, Bolney, Sussex, for **Valentine's Queen of Payhay.**
H.C.—1606, 1607. C.—1597, 1600.

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[1] Champion Prize of £5 given by the English Guernsey Cattle Society for the best Bull.
[2] The "Calehill" Silver Challenge Cup given by the English Guernsey Cattle Society for the best Bull.
[3] Champion Prize of £5 given by the English Guernsey Cattle Society for the best Cow or Heifer.
[4] The "Fernhill" Silver Challenge Cup given by the English Guernsey Cattle Society for the best Cow or Heifer.
[5] Prizes, except Fourth, given by the English Guernsey Cattle Society.

Class 208.—*Guernsey Heifers, born in* 1933.

1610 I., R.N. for Champion[1] & R.N. for Champion.[2]—W. DUNKELS, Fernhill Park, Windsor Forest, for 41195 Fernhill Rose 8th, fawn and white, born March 29; *s.* Fernhill Robert 5th 7795, *d.* 18813 Fernhill Rose *by* Murrell Desmond 4263.

1615 II.—MRS. J. SUTCLIFFE PYMAN, Norsebury, Sutton Scotney, Hants., for 42513 Iona 2nd of Myrtle Place, fawn and white, born Jan. 9, bred by E. de Garis, Myrtle Place, Castel, Guernsey; *s.* Le Hechet's Renown 3rd 5745 P.S., *d.* 32603 P.S. Iona of Myrtle Place *by* Valentine's Galore of Maple Lodge 5437 P.S.

1611 III.—H. A. Y. DYSON, Dalton, Bolney, Sussex, for 42467 Daisy of Payhay, fawn and white, born May 8; *s.* Dissiford Viking 8559, *d.* 20295 Gaskyns Daisy 8th *by* Poltimore President 4576.

1613 R.N.—MRS. JANE GREENSHIELDS, Ivy House, East Herrington, Sunderland, for Herrington Oonagh.
H.C.—1612. C.—1616.

Class 209.—*Guernsey Heifers, born in* 1934.

1620 I.—W. DUNKELS, Fernhill Park, Windsor Forest, for 45364 Fernhill Primrose 7th, fawn and white, born July 5; *s.* Fernhill Robert 5th 7795, *d.* 38921 Fernhill Primrose 6th *by* Lavender's Slogan of La Hougue 7839.

1631 II.—CAPT. L. REGINALD WAUD, Bradley Court, Chieveley, Newbury, for 45820 Bradley Maggie 6th, fawn and white, born July 19; *s.* Firebrand of Marsh Close 8088, *d.* 31602 Bradley Maggie *by* Tregothnan Farmer 6243.

1623 III.—CARL HOLMES, Clover Top Farm, Codicote, Hitchin, for 44306 Peach Blossom 5th of Clover Top, fawn and white, born Jan. 27; *s.* Fernhill Robert 6th 9465, *d.* 38027 Peach Blossom 2nd of Clover Top *by* Gem's Conqueror 2nd 7048.

1624 IV.—CARL HOLMES, for 44658 Rosey 2nd of Clover Top, fawn and white, born March 25; *s.* Fernhill Robert 6th 9465, *d.* 21280 Rosey of Goodnestone 20th *by* Sequel's Slogan 2nd 4311.

1627 V.—ERIC H. ROSE, Leweston Manor, Sherborne, Dorset, for 47040 Leweston Princess Mary 8th, fawn and white, born Aug. 4; *s.* Leweston Rose Lad 7790, *d.* 17649 Downe Princess Mary 5th *by* Downe Valentine's Honour of Vimiera 3913.

1625 R.N.—DAME E. LOCKE KING, Brooklands, Weybridge, for Shiwa Rose Lad's Doris.
H.C.—1626, 1630. C.—1629.

Specials.[3]—I., £8, MRS. JANE GREENSHIELDS; II., £5, G. W. GREENSHIELDS.

Jerseys.

N.B.—In the Jersey Classes, the number inserted within brackets after the name of an animal indicates the number of such animal in the Island Herd Book. A number without brackets indicates that the animal is registered in the English Jersey Herd Book.

Class 210.—*Jersey Bulls, born in or before* 1932.

1635 I. & Champion.[4]—WILLIAM E. PRESS, Wolvers, Reigate, for Wolvers Rufus 17968, whole, born May 14; *s.* Hook Cæsar 17198, *d.* 9717 Margawse *by* Palatine's Observer 15400.

1637 II. & R.N. for Champion.[4]—HAYDON STEPHEN-FOX, Sharelands, Blackboys, Sussex, for Pioneer's Don Silver 16059, whole, born June 30, 1927, bred by Viscount Cowdray, Midhurst; *s.* Groombridge Don Silver 15868, *d.* Pioneer's Lady *by* Pioneer's Noble 12416.

1634 SIR HAROLD MACKINTOSH, BART., Conyngham Hall, Knaresborough, for Joubert 16587, whole, born May 27, 1928, bred by Lady Estella Hope, South Park, Bodiam, Sussex; *s.* Purple Emperor 16066, *d.* 643 Jolie *by* Ecclesdon Peter 13556.

1638 R.N.—SIR JOHN B. LLOYD, Foxbury, Stone Street, Sevenoaks, for Foxbury Arkona's Count.

Class 211.—*Jersey Bulls, born in* 1933.

1643 I.—OVALTINE DAIRY FARM, Abbots Langley, Herts., for The Wizard 18417, whole, born July 19, bred by Lady Violet Henderson, Buscot Park, Faringdon; *s.* Wotton Hustler 16500, *d.* 12461 Circe *by* The Slasher 14133.

1640 II.—MRS. FRANK HILDER, Huskards, Ingatestone, for Ovaltine Wonderful Lad 18353, whole, born April 28, bred by A. Wander Ltd., Ovaltine Dairy Farm, Abbots Langley; *s.* Design's Fern Oxford jnr. 18008, *d.* Wonderful Sultana 21800 *by* Wonderful Standard 16207.

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[1] Champion Prize of £5 given by the English Guernsey Cattle Society for the best Cow or Heifer.

[2] The "Fernhill" Silver Challenge Cup given by the English Guernsey Cattle Society for the best Cow or Heifer.

[3] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the Guernsey Classes.

[4] Champion Prize of £5 given by the English Jersey Cattle Society for the best Bull.

1646 III.—THE HON. MRS. TENNANT, St. Anne's Manor, Sutton Bonington, Loughborough, for **Wonderful Regent** 18459 whole, born Jan. 13; *s.* Hauteville Regent 16027, *d.* 18677 Wonderful Novelette *by* Wonderful Standard 16207.

1639 R.N.—MRS. HENRY HAWKINS, Everdon Hall, Daventry, for **Somborne Pioneer's Dreamer.**

H.C.—1642.

Class 212.—*Jersey Bulls, born in* 1934.

1652 I. & Champion.[1]—J. W. McCALLUM, Grange Farm, Chartridge, Chesham, Bucks, for **Wotton Fog** 18970, whole, born Jan. 18, bred by Mrs. Evelyn, Wotton, Dorking; *s.* Wotton Sandpole 16786, *d.* 11846 Wotton Haze *by* Wotton Airman 2nd 14502.

1647 II.—MRS. G. J. CADDEY, Manor House, Egham, Surrey, for **Egham Gold Standard** 18688, whole, born Aug. 20; *s.* Vinchele Golden Victory 2nd 19085, *d.* 25023 Wonderful Etta *by* Wonderful Standard 16207.

1660 III. & R.N. for Champion.[1]—W. HUMPHREYS PRESCOTT, Highlands, Woldingham, Surrey, for **Groombridge Jersey Milkman** 18730, whole, born April 18, bred by H. S. Mountain, Groombridge Place, Groombridge, Kent; *s.* Sir Laurel 15228, *d.* 2060 Jersey Surprise *by* Xenia's Sultan 2nd 14511.

1648 IV.—MRS. HENRY HAWKINS, Everdon Hall, Daventry, for **Everdon Dreaming Pioneer** 18698, whole, born May 10; *s.* Voyageur 18571, *d.* 24993 Vanda's Bitter Sweet *by* Dreaming Bob 16436.

1659 V.—MRS. A. E. PHILLIPS, Old Dalby Hall, Melton Mowbray, for **Marston Kingsway** 18811, whole, born Jan. 24, bred by W. Wilkins, Long Marston, Tring; *s.* Francfref Don 18022, *d.* Linnea *by* Dreaming Pioneer 16714.

1661 R.N.—MISS G. M. YULE, Hanstead House, Bricket Wood, St. Albans, for **Beau Laurel.**

H.C.—1651. C.—1653.

Class 213.—*Jersey Cows, in-milk, born in or before* 1931.

1667 I. & Champion.[2]—SIR JOHN B. LLOYD, Foxbury, Stone Street, Sevenoaks, for 24632 **Dreaming Fleckie Lass**, broken fawn, born May 31, 1930, calved April 15, 1935, bred by Mrs. Mauger, Jersey; *s.* Dreaming Pioneer 16714, *d.* 35563 Fleckie Lass *by* Lily's Pride King 15048.

1666 II.—SIR JOHN B. LLOYD, for 18340 **Arkona's Viscountess**, broken fawn, born March 18, 1929, calved April 9, 1935, bred by J. A. Romerie, St. Peters, Jersey; *s.* Floral Dance's You'll Do 16568, *d.* (26692) Arkona 4th *by* April Wonder 12826.

1674 III.—SIR HAROLD MACKINTOSH, BART., Conyngham Hall, Knaresborough, for 25026 **Wonderful Peggy**, dark fawn, born March 25, 1931, calved Feb. 6, 1935, bred by J. M. Le Boutillier, St. Ouens, Jersey; *s.* Fillpail's Wonderful Volunteer 17504, *d.* (38002) Peggy O'Connor *by* Millais Baron 15381.

1670 IV.—J. W. McCALLUM, Grange Farm, Chartridge, Chesham, Bucks., for 24718 **Highstead's Viscountess**, whole, born May 1, 1929, calved April 22, 1935, bred by F. R. Ozouf, St. Saviours, Jersey; *s.* Viscount of Oaklands 16688, *d.* (36671) Tapon's Designing Poppy *by* Poppy's You'll Do 16060.

1678 V.—M. F. NORTH, Loxwood House, Billingshurst, for 8559 **Snowball**, broken, born Nov. 12, 1925, calved May 9, 1935, bred by W. W. Hughes D'Aeth, Jersey; *s.* Little Gambler 14675, *d.* Gutta Persha *by* Boy's Old 13192.

1675 R.N.—M. F. NORTH, for **Gracious Lady.**

H.C.—1662, 1665, 1668, 1677, 1678, 1681, 1682. C.—1663, 1672.

Class 214.—*Jersey Heifers, in-milk, born in* 1932.

1690 I. & Special II.[3]—W. HUMPHREYS PRESCOTT, Highlands, Woldingham, Surrey, for 16433 **Gnome's Sweetbread of Highlands**, whole, born May 7, calved June 28, 1935; *s.* Fairseat Gnome 16564, *d.* 17915 Sweetbread of Highlands *by* Highlight of Highlands 16149.

1685 II.—M. F. NORTH, Loxwood House, Billingshurst, for 17201 **Mignonette**, whole, born April 28, 1932, calved June 5, 1935, bred by Mrs. Austin, Totteridge, Herts.; *s.* Majestic 15885, *d.* 11269 Marigolds Beauty *by* Dusky Beau 16135.

1695 III.—THE HON. MRS. TENNANT, St. Anne's Manor, Sutton Bonington, Loughborough, for 21796 **Wonderful Countess**, whole, born June 5, calved April 14, 1935, bred by C. Le Herrison, Trinity, Jersey; *s.* Wonderful Standard 16207, *d.* (39544) Les Ormes Countess *by* Ida's Rosebay 13982.

1691 IV.—COLIN S. RICHARDSON, Wheelbirks, Stocksfield, for 18168 **Wheelbirks Rondelle**, whole, born May 14, calved June 22, 1935; *s.* Conyngham Beau 16827, *d.* 9988 Rondo *by* Fontaine's Oxford Sultan 14284.

1687 R.N.—OVALTINE DAIRY FARM, Abbots Langley, Herts., for **Royal Kitty.**

H.C.—1686, 1688. C.—1692, 1696.

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[1] The "Meridale" Perpetual Silver Challenge Cup given through the English Jersey Cattle Society for the best yearling Bull from recorded dam.

[2] Champion Prize of £5 given by the English Jersey Cattle Society for the best Cow or Heifer.

[3] Special Prize of £10 (First Prize) and £5 (Second Prize) given by the English Jersey Cattle Society for the best Cows or Heifers in Classes 213 to 215, bred by Exhibitor, and milked out to the Judge's satisfaction before being judged.

Class 215.—*Jersey Heifers, in-milk, born in* 1933.[1]

1707 I., R.N. for Champion[2] & Special I.[3]—W. HUMPHRYS PRESCOTT, Highlands, Woldingham, Surrey, for 19668 Glory Boy's Highbrow of Highlands, nearly whole, born May 17, calved May 26, 1935; *s.* Glory Boy of Highlands 17171, *d.* 9464 Highbrow of Highlands *by* Les Petits Canons Prudence Prince 15882.

1708 II. & Special III.[3]—WILLIAM E. PRESS, Wolvers, Reigate, for 21322 Wolvers Majesty's Dairymaid, whole, born March 28, calved May 29, 1935; *s.* Hook Cæsar 17198, *d.* 3647 Majesty's Xenith *by* Sybil's Financial Jolly 14470.

1706 III.—OVALTINE DAIRY FARM, Abbots Langley, Herts., for 20542 Ovaltine Princess, whole, born June 1, calved June 3, 1935; *s.* Right of La Place 18542, *d.* 18575 Primrose Mercedes *by* Bravo 15834.

1703 R.N.—M. F. NORTH, Loxwood House, Billingshurst, for Conyboro Lady Neptune.
H.C.—1700, 1701, 1704.

Class 216.—*Jersey Heifers, born in* 1934.

1709 I.—MRS. G. J. CADDEY, Manor House, Egham, Surrey, for Marston Wonder, broken, born April 16, bred by W. Wilkins, Long Marston, Tring; *s.* Wonderful Standard 16207, *d.* Baby Blue of Oaklands *by* Right Royal 16642.

1719 II.—OVALTINE DAIRY FARM, Abbots Langley, Herts., for 23645 Ovaltine Coy Girl, whole, born May 10; *s.* Right of La Place 18542, *d.* 18565 Parity *by* Nobly's Emperor 17548.

1721 III.—OVALTINE DAIRY FARM, for 23653 Ovaltine Playmate, broken, born June 6; *s.* Right of La Place 18542, *d.* 21676 Playmate of Oaklands *by* Right Royal 16642.

1710 IV.—MRS. FRANK HILDER, Huskards, Ingatestone, Essex, for 23446 May-of-Oxon, whole, born Feb. 10, bred by Mrs. M. Halford-Adcock, Grenehurst Park, Capel; *s.* Nut-of-Oxon 17313, *d.* 13822 Mayfly of Oxon *by* Fussey's Jim 15651.

1714 V.—SIR JOHN B. LLOYD, Foxbury, Stone Street, Sevenoaks, for 23443 Mayflower, nearly whole fawn, born Jan. 24, bred by Mrs. Micklem, Bitchet Wood, Sevenoaks; *s.* Foxbury Blonde's Bridegroom 17158, *d.* 15305 Pilgrim's Progress *by* Pilgrim of Oaklands 16180.

1720 R.N.—OVALTINE DAIRY FARM, for Ovaltine Milkmaid.
H.C.—1713, 1715, 1716, 1722, 1723.
Cup.[4]—OVALTINE DAIRY FARM.
R.N. for Cup[4].—W. HUMPHRYS PRESCOTT.
Specials.[5]—I., £8, COLIN S. RICHARDSON; II., £5, THE HON. J. A. JOICEY.

Kerrys.

N.B.—In the Kerry Classes, the number inserted within brackets after the name of an animal indicates the number of such animal in the Royal Dublin Society's Herd Book. A number without brackets indicates that the animal is registered in the British Kerry Herd Book.

Class 217.—*Kerry Bulls, born in or before* 1933.

1732 I. & Champion.[6]—BERTRAM W. A. WATNEY, Brookwood Corner, Holmwood, Surrey, for Cheselbourne Gabriel 881, born Jan. 8, 1930, bred by Mrs. Freeland, Cheselbourne Manor, Dorset; *s.* Valencia Minstrel 667, *d.* Cheselbourne Garland 4328 *by* Duv Demon 640.

1728 II.—LT.-COL. J. A. INNES, D.S.O., Horringer Manor, Horringer, Bury St. Edmunds, for Brookwood Egbert 963, born Aug. 5, 1933, bred by Bertram W. A. Watney, Brookwood Corner, Holmwood, Surrey; *s.* Cheselbourne Gabriel 881, *d.* Montalto Kathlina of O.P.H. 4168 *by* North Star of Carton 516.

1730 III.—H. E. MITCHELL, Great Pellingbridge Farm, Scaynes Hill, Sussex, for O.P.H. Paliful Curley 848, born June 8, 1929, bred by Capt. R. E. Palmer, Newdigate, Surrey; *s.* Paliful Jim of O.P.H. 772, *d.* Elmhurst Cresta 3569 *by* Valencia Linksman 496.

1729 R.N.—THE KERRY COW DAIRY FARMS, Layer-de-la-Haye, Colchester, for Drumgaunagh Pharoah.
H.C.—1731.

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[1] Prizes given by the English Jersey Cattle Society.

[2] Champion Prize of £5 given by the English Jersey Cattle Society for the best Cow or Heifer.

[3] Special Prize of £10 (First Prize) and £5 (Second Prize) given by the English Jersey Cattle Society for the best Cows or Heifers in Classes 213 to 215, bred by Exhibitor, and milked out to the Judge's satisfaction before being judged.

[4] The "Conyngham" Perpetual Silver Challenge Cup given through the English Jersey Cattle Society for the most points awarded in a combination of entries.

[5] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the Counties of Northumberland or Durham for most points awarded in a combination of entries in the Jersey Classes.

[6] Silver Challenge Cup given by the British Kerry Cattle Society for the best Kerry.

Class 218.—*Kerry Bull, born in* 1934.

1736 I.—BERTRAM W. A. WATNEY, Brookwood Corner, Holmwood, Surrey, for **Brookwood Frolicsome** 980, born April 25; *s.* Cheselbourne Gabriel 881, *d.* Brookwood Claire 5358 *by* Chaldon Hornet 758.
1734 II.—H. E. MITCHELL, Great Pellingbridge Farm, Scaynes Hill, Sussex, for **Barrington Majestic**, born March 18; *s.* Ard Caein Majestic 875, *d.* Valencia Jade 4654 *by* Valencia Sammy 670.
1735 III.—NEWTON R. STEEL, Hookland Estate, Scaynes Hill, Sussex, for **Hookland Emperor**, born April 30; *s.* Ard Caein Ultimo 920, *d.* Pallas Victoria 5044 *by* Valencia Czar 534.

1733 R.N.—MISS HONOR G. B. BOWEN-COLTHURST, Vernons, Chappel, Colchester, for **Coolock Leo.**

Class 219.—*Kerry Cows, in-milk, born in or before* 1931.

1742 I.—NEWTON R. STEEL, Hookland Estate, Scaynes Hill, Sussex, for **Pallas Victoria** 5044, born March 3, 1924, calved April 18, 1935, bred by J. C. McKay, Pallas House, Beaufort, Co. Kerry; *s.* Valencia Czar 534, *d.* Pallas Vanity 2747 *by* Pallas Paddy 2nd 818.
1737 II.—LT.-COL. J. A. INNES, D.S.O., Horringer Manor, Horringer, Bury St. Edmunds, for **Ard Caein Doe** 5506, born Dec. 23, 1930, calved May 11, 1935, bred by S. J. Brown, Ard Caein, Naas, Co. Kildare; *s.* Ard Caein Secundus 749, *d.* Ard Caein Dove 3331 *by* Ard Caein Prince 6th 428.
1739 III.—H. E. MITCHELL, Great Pellingbridge Farm, Scaynes Hill, Sussex, for **Cuckfield Pearl** 4082, born May 20, 1925, calved June 9, 1935, bred by J. E. Johnston, Cuckfield, Sussex; *s.* Ard Caein Norval 628, *d.* Buckhurst Pearl 1875 *by* Lackham Puzzler 255.

1740 R.N.—NEWTON R. STEEL, for **Algernon Best-of-All.**
H.C.—1738.

Class 220.—*Kerry Heifers, in-milk, born in* 1932 *or* 1933.

1746 I. & R.N. for Champion.[1]—NEWTON R. STEEL, Hookland Estate, Scaynes Hill, Sussex, for **Hookland Constance**, born April 16, 1932, calved May 3, 1935; *s.* Valencia Minstrel 667, *d.* Muckross Moscow 5000 *by* Muckross Nosegay 1126.
1745 II.—H. E. MITCHELL, Great Pellingbridge Farm, Scaynes Hill, Sussex, for **Barrington Dame** 5640, born March 26, 1933, calved April 16, 1935; *s.* O.P.H. Pailful Curley 848, *d.* Lanky Dame 4968 *by* Southwater Gay Boy 569.
1743 III.—MISS HONOR G. B. BOWEN-COLTHURST, Vernons, Chappel, Colchester, for **Minley Prudence** 5573, born July 27, 1932, calved March 12, 1935, bred by Laurence Currie, Minley Manor, Farnborough; *s.* Elmhurst Invader 833, *d.* Minley Catherine 4987 *by* Hattingley Beano 691.

1744 R.N.—THE KERRY COW DAIRY FARMS, Layer-de-la-Haye, Colchester, for **Winterdale Clover Leaf.**

Dexters.

N.B.—In the Dexter Classes, the number inserted within brackets after the name of an animal indicates the number of such animal in the Royal Dublin Society's Herd Book. A number without brackets indicates that the animal is registered in the English Dexter Herd Book.

Class 221.—*Dexter Bulls, born in or before* 1933.

1748 I. & R.N. for Champion.[2]—THE REV. E. A. DOUGLAS MORGAN, Trefonen Rectory, Oswestry, for **Grinstead Nigger Boy** 1153, born July 12, 1932, bred by Lady Loder, Leonardslee, Horsham; *s.* Ratcliffe Negro's Manager 1096, *d.* Grinstead Hawk 7th 4203 *by* Oakridge Evergood 2nd 1014.
1749 II.—MRS. T. H. PEYTON, Colomendy, Mold, for **Colomendy Dick Turpin** 1149, born May 3, 1933; *s.* Radcliffe Dairyman 1076, *d.* Gaynes Gay 3800 *by* Cobham Blacksmith 727.
1747 III.—MRS. LEATHAM, The Manor, Bagendon, Cirencester, for **Bagendon Submarine**, born April 16, 1932; *s.* Bagendon Trifle 991, *d.* Bagendon Supreme 1st 4474 *by* Bagendon Spear 990.

Class 222.—*Dexter Bulls, born in* 1934.

1751 I.—MRS. ERNEST JOHNSON, Ashton Hayes, Chester, for **Ashtonhayes Red Hugh**, born April 30; *s.* Grinstead Taxi 1089, *d.* Grinstead Oxlip 2nd 3629 *by* Oakridge Sentry 796.

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[1] Silver Challenge Cup given by the British Kerry Cattle Society for the best Kerry.
[2] Silver Challenge Cup given by the Dexter Cattle Society for the best Dexter.

Class 223.—*Dexter Cows, in-milk, any age.*

1757 I. & Champion.[1]—Mrs. T. H. Peyton, Colomendy, Mold, for Thorp Dora 4337, born Feb. 6, 1928, calved May 5, 1935, bred by the Hon. Mrs. Grenfell, Beenham Court, Newbury; *s.* Young Jolly 986, *d.* Barrow Dora 4th 2827 *by* Barrow Beau 3rd 622.
1755 II.—Miss N. M. Lloyd, Pentre Hobyn, Mold, for Pentre Hobyn Jasmine 4145, born April 22, 1927, calved April 7, 1935; *s.* Grinstead Watersprite 928, *d.* Brokenhurst Jonquil 3240 *by* Brokenhurst Philip 726.
1753 III.—Mrs. Ernest Johnson, Ashton Hayes, Chester, for Ashtonhayes Creina 4543, born May 20, 1932, calved May 6, 1935; *s.* Grinstead Taxi 1089, *d.* Grinstead Convolvulus 3458 *by* Brokenhurst Penny 2nd 694.
1754 R.N.—Mrs. Ernest Johnson, for Ashtonhayes Woodlawn.
H.C.—1756.

Class 224.—*Dexter Heifers, in-milk to first calving, born in 1932 or 1933.*

1759 I.—Mrs. Ernest Johnson, Ashton Hayes, Chester, for Ashtonhayes Woodlawn 2nd, born March 29, 1933, calved May 23, 1935; *s.* Braxted Primate 1131, *d.* Ashtonhayes Woodlawn 4472 *by* Grinstead Taxi 1089.
1758 II.—Mrs. Ernest Johnson, for Ashtonhayes Honor 2nd, born June 17, 1933, calved May 31, 1935; *s.* Grinstead Crowberry 1042, *d.* Ashtonhayes Honor 3802 *by* Grinstead Farrier 787.
1760 III.—Mrs. T. H. Peyton, Colomendy, Mold, for Colomendy Mary 3rd 4581, born March 20, 1933, calved June 17, 1935; *s.* Ratcliffe Dairyman 1076, *d.* Colomendy Mary 3787 *by* Oakridge Sentry 796.

Milk Yield Classes.

Class 225.—*Dairy Shorthorn Cows or Heifers.*

1132 I.—Frederick Chapman, for Blossom. (See Class 157.)
1143 II.—Frederick Chapman, for Primrose Gift. (See Class 158.)
1138 III.—J. Pierpont Morgan, Wall Hall, Aldenham, Watford, for Aldenham Kirklevington Lady 3rd, red, born June 15, 1927, calved May 12, 1935; *s.* Aldenham Kirklevington Duke 2nd 204357, *d.* 77344 Aldenham Kirklevington Lady *by* Cotlands Waterloo Duke 6th 155058.
1137 R.N.—J. Pierpont Morgan, for Aldenham Dot 6th.
H.C.—1135, 1151.

Class 226.—*Lincolnshire Red Shorthorn Cows or Heifers.*

1243 I.—Russell Wood, Bendish House, Hitchin, for Bendish Nancy 18th (Vol. 36, p. 368), born Nov. 12, 1929, calved May 13, 1935; *s.* Ketteringham Milkman 19549, *d.* Bendish Nancy 5th *by* Burton Ruby King 2nd 14314.
1239 II.—Frank Sainsbury, for Wratting Cherry. (See Class 165.)
1244 III.—Russell Wood, for Bendish Woodland Rose 6th (Vol. 34, p. 394), born May 21, 1927, calved June 11, 1935; *s.* Langford Bendish 19564, *d.* Bendish Woodland Rose 4th *by* Burton Ruby King 2nd 14314.
1236 R.N.—John Evens & Son, Burton, Lincoln, for Bracebridge Lady.

Class 227.—*South Devon Cows or Heifers.*
[No Entries.]

Class 228.—*Red Poll Cows or Heifers.*

1308 I.—Stuart Paul, Kirton Lodge, Ipswich, for Model Victoria, born Oct. 6, 1923, calved June 1, 1935, bred by A. B. Longe, Pettistree Grange, Wickham Market; *s.* Combs Hervic 11912, *d.* 26963 Henham Victoria *by* Manor Ash 11033.
1322 II.—Edward Hinchliffe, Applegarth House, Ottringham, Hull, for 45908 Ottringham Violet, born June 19, 1930, calved May 20, 1935, bred by R. Hinchliffe, Ottringham; *s.* Ottringham King 15073, *d.* 31614 Royal Pansy *by* Royal Crimson 11763.
1299 III.—Lord Cranworth, Grundisburgh Hall, Woodbridge, for 43388 Grundisburgh Good Duck, born July 22, 1929, calved May 12, 1935; *s.* Longford Drake 14229, *d.* 35746 Grundisburgh Good Luck *by* Framlingham Fanatic 12612.
1314 R.N.—C. H. Cearn, for Abbeycombe Fatsia. (See Class 177.)
H.C.—1295, 1304.

Class 229.—*Blue Albion Cows or Heifers.*

1362 I.—Charles Henry Webster, Ivonbrook Farm, Grange Mill, Derby, for Ivonbrook Amy 13086, born March 3, 1931, calved June 10, 1935; *s.* Ivonbrook Masterpiece 1707, *d.* Ivonbrook Lavender 12048.
1359 II.—W. E. Glover, for Mount Croesus 3rd. (See Class 182.)

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[1]Silver Challenge Cup given by the Dexter Cattle Society for the best Dexter.

Class 230.—*British Friesian Cows or Heifers.*

1432 I.—LORD RAYLEIGH, The Bury, Hatfield Peverel, Chelmsford, for **Terling Ivory 16th** 121830, born March 15, 1927, calved May 28, 1935; *s.* Terling (imp. 1922) Marthus 21533, *d.* Terling Ivory 10th 49222 *by* Lavenham (imp.) Gysbrecht 4077.
1423 II.—CECIL BALL, Market Place, Oakham, for **Oakham Dairymaid** 139970, born March 17, 1929, calved June 8, 1935; *s.* Topton Count 27231, *d.* Masham Series Dainty 84866 *by* Hedges Second Series 6427 P.I.
1424 III.—ARTHUR BARBER, for **Whaley Lavender.** (See Class 191.)

1433 R.N.—LORD RAYLEIGH, for **Terling Thyme 17th.**
H.C.—1426.

Class 231.—*Ayrshire Cows or Heifers.*

1518 I.—A. D. & J. MURCHIE, Copt Hall, Luton, for **Bogside Butter Fat** 39705, born Feb. 19, 1929, calved June 14, 1935, bred by A. D. Murchie, Copt Hall; *s.* Bargenoch Dandy Desmond 26302, *d.* Bogside Fenella 39707 *by* Overton Foundation 17337.
1521 II.—D. H. SANDERSON, The Birks, Stamfordham, Newcastle-on-Tyne, for **Newlands Acorn** 83745, born Nov. 23, 1921, calved June 9, 1935, bred by C. H. Sanderson, Newlands, Belford; *s.* Howie's Monarch 16975, *d.* Newlands Elma 70714 *by* Newlands King 16764.
1525 III.—WILLIAM WILSON, Main Street, Crumlin, Co. Antrim, for **Thornhill Morag 2nd** 25063, born March 7, 1929, calved June 13, 1935, bred by A. Cunningham, Cragston, Stewarton; *s.* Lessnessock Monomark 27718, *d.* Thornhill Morag 7916 *by* Nether Craig Financier 23448.

1501 R.N.—CAPT. W. B. DRONSFIELD, The Manor House, Wilmcote, Stratford-on-Avon, for **Knowe Orange Blossom.**

Class 232.—*Guernsey Cows or Heifers.*

1589 I.—CARL HOLMES, for **Dairy Queen of Clover Top.** (See Class 206.)
1586 II.—G. W. GREENSHIELDS, Clover Top, North Grindon, Sunderland, for 28588 **Herrington Bridesmaid,** fawn and white, born April 28, 1928, calved June 16, 1935, bred by E. Greenshields, East Herrington; *s.* Polly's Fancy of Grand Pré 5198 P.S., *d.* 27928 Le Friquet Rosie 2nd *by* Nellie's Emblem 4433 P.S.
1609 III.—MRS. YORKE, for **Peter's Jennette.** (See Class 207.)
1591 IV.—CARL HOLMES, for **May Rose of Clover Top.** (See Class 206.)
1593 V.—LORD SWAYTHLING, Town Hill Park, West End, Southampton, for 37079 **De Baugy's Midget 5th,** fawn and white, born Aug. 14, 1930, calved June 2, 1935, bred by J. Hall, Havilland, Guernsey; *s.* De Baugy's Daisy's Leader 5171 P.S., *d.* 25729 P.S. De Baugy's Midget *by* Princess's Lad 4682 P.S.

1607 R.N.—LORD SWAYTHLING, for **Bladen Gay Lass 2nd.**
H.C.—1581, 1590, 1605, 1606, 1608.

Class 233.—*Jersey Cows or Heifers.*

1682 I.—COLIN S. RICHARDSON, Wheelbirks, Stocksfield, for 11807 **Wheelbirks Cornelia,** whole, born Oct. 21, 1927, calved May 25, 1935; *s.* Wotton Valentine Mail 15474, *d.* 4453 Bluff Agate *by* Raphael 15752.
1674 II.—SIR HAROLD MACKINTOSH, BART., for **Wonderful Peggy.** (See Class 213.)
1672 III.—SIR HAROLD MACKINTOSH, BART., for 13052 **Golden Bessie,** whole, born May 11, 1931, calved May 29, 1935, bred by the Hon. Mrs. Esmé Smyth, Long Ashton, Bristol, *s.* Kingston Golden Sultan 16894, *d.* 12092 Bessie *by* Novikoff 15890.
1669 IV.—S. S. LOCKWOOD, Normanby Hill Dairy, Sinnington, York, for 11675 **Stonehurst Patrician's Sepia,** whole, born April 2, 1928, calved June 10, 1935, bred by Miss M. A. Bashall, Stonehurst Farm, Chiddingfold; *s.* Penshurst Patrician 14895, *d.* 4083 Stonehurst Sepia *by* Tidy Gamboge 14145.
1662 V.—MRS. G. J. CADDEY, Manor House, Egham Surrey, for 17510 **Precious Bane,** whole, born June 6, 1930, calved June 13, 1935, bred by Miss Ryan MacMahon, Fowler's Wells Farm, Chobham; *s.* Valentine 15907, *d.* 8134 Lockyers Martinet's Cowslip *by* Lockyers Martinet 15202.

1675 R.N.—M. F. North, for **Gracious Lady.** (See Class 213.)
H.C.—1663, 1664, 1667, 1670, 1676, 1681, 1695.

Class 234.—*Kerry Cows or Heifers.*

1742 I. & Champion.[1]—NEWTON R. STEEL, for **Pallas Victoria.** (See Class 219.)
1739 II. & R.N. for Champion.[1]—H. E. MITCHELL, for **Cuckfield Pearl.** (See Class 219.)
1737 III.—LT.-COL. J. A. INNES, D.S.O., for **Ard Caein Doe.** (See Class 219.)

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[1] The "Elmhurst" Perpetual Silver Challenge Cup given by the British Kerry Cattle Society for the Kerry Cow in Class 234 gaining the highest number of points.

Class 235.—*Dexter Cows or Heifers.*

1757 I. & Champion.[1]—MRS. T. H. PEYTON, for Thorp Dora. (See Class 223.)
1754 II. & R.N. for Champion.[1]—MRS. ERNEST JOHNSON, Ashton Hayes, Chester, for Ashtonhayes Woodlawn 4472, born Feb. 14, 1931, calved May 3, 1935; *s.* Grinstead Taxi 1039, *d.* Grinstead Watercress 2774 *by* Hever Tim 636.
1756 III.—MRS. T. H. PEYTON, for Colomendy Gay 4187, born May 23, 1927, calved April 19, 1935; *s.* Grinstead Tony 841, *d.* Gaynes Gay 3800 *by* Cobham Blacksmith 727.

Butter Tests.

Class 236.—*Cows of the Guernsey, Jersey, Kerry or Dexter Breeds.*

1589 I. & R.N. for Champion.[2]—CARL HOLMES, for Dairy Queen of Clover Top. (See Class 206.)
1682 II. & G.M.[3]—COLIN S. RICHARDSON, for Wheelbirks Cornelia. (See Class 233.)
1674 III. & S.M.[3]—SIR HAROLD MACKINTOSH, BART., for Wonderful Peggy. (See Class 213.)
1607 IV.—LORD SWAYTHLING, Townhill Park, West End, Southampton, for 38929 Bladen Gay Lass 2nd, fawn and white, born May 15, 1932, calved Nov. 19, 1934, bred by Sir Ernest Debenham, Bart., Bladen, Briantspuddle, Dorset; *s.* Milton Rose Lad 7330, *d.* 14828 Tregothnan Gay Lass *by* Nicollés Fleuri Sequel 3378.
1676 V. & B.M.[3]—M. F. NORTH, for Snowball. (See Class 213.)

1662 R.N.—MRS. G. J. CADDEY, for Precious Bane. (See Class 233.)
H.C.—1581, 1591, 1605, 1608, 1663, 1664, 1669, 1670, 1675, 1739.
Certificates of Merit.[4]—1581, 1591, 1605.
Certificates of Merit.[5]—1662, 1663, 1664, 1669, 1670, 1675, 1681.

Class 237.—*Cows of any other Breed.*

1423 I. & Champion.[2]—CECIL BALL, for Oakham Dairymaid. (See Class 230.)
1359 II.—W. E. GLOVER, for Mount Crocus 3rd. (See Class 182.)
1143 III.—FREDERICK CHAPMAN, for Primrose Gift. (See Class 158.)
1137 IV.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for 110389 Aldenham Dot 6th, red and little white, born May 12, 1928, calved April 14, 1935; *s.* Aldenham Lord Kirklevington 212843, *d.* 88973 Aldenham Dot 4th *by* Aldenham Lord Barrington 177679.

GOATS.[6]

The Prizes in each Class for Goats are: First Prize, £5; Second Prize, £3; Third Prize, £2; Fourth Prize, £1; Fifth Prize, 10s.

Class 238.—*Toggenburg Female Goats, in-milk, any age.*

1761 I. & Champion.[7]—MISS ALEXANDER, Byards Lodge, Knaresborough, for Stockwell Calsie 732, born Jan. 1, 1932, kidded Jan. 17, 1935; *s.* Murrayston Hal 675, *d.* Stockwell Corella 658 *by* Sandhill Monday 553.
1763 II. & R.N. for Champion.[7]—MISS MARJORIE HENDERSON, The Riding, Hexham, for Riding Chloe 727, born Feb. 7, 1932, kidded Feb. 8, 1935; *s.* Murrayston Buchan 632, *d.* Riding Cordelia 679 *by* Fryston Standard 621.
1762 III.—MISS ALEXANDER, for Stockwell Corinne 670, born Jan. 30, 1929, kidded Dec. 25, 1934; *s.* Leazes Prince Hal 643, *d.* Stockwell Correopsis 551 *by* Edel 524.

Class 239.—*Saanen Female Goats, in-milk, any age.*

1766 I. & Champion.[8]—MISS CECILY BOOTH, Yore Croft, Ripon, for Didgemere Salome 178, born Feb. 2, 1931, kidded March 4, 1934, bred by Mrs. Abbey, Downe Hall, Roydon; *s.* Didgemere Sidney 115, *d.* Broxbourne Maud 63 *by* Gulden 37.

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[1] Perpetual Silver Challenge Cup given by the Dexter Cattle Society for the Dexter Cow in Class 235 gaining the highest number of points.
[2] Champion Gold Medal given for the Cow obtaining the highest number of points.
[3] Gold Medal (or £10 in money), Silver Medal and Bronze Medal given by the English Jersey Cattle Society for the three Jersey Cows obtaining the greatest number of points in the Butter Tests.
[4] Certificates of Merit given by the English Guernsey Cattle Society for Guernsey Cows, not being Prize Winners, obtaining the following points: Cows four years old and under, 36; Cows over four years old, 41.
[5] Certificates of Merit given by the English Jersey Cattle Society for Jersey Cows, not being Prize Winners, obtaining the following points; Cows four years old and under, 36; Cows over four years old, 41.
[6] £40 towards these prizes was given by the British Goat Society, and all the Challenge Certificates, Medals and Cups enumerated below, and on pages lxxxv to lxxxviii were given through the British Goat Society.
[7] Breed Challenge Certificate for the best Toggenburg Female Goat, over 2 years old.
[8] Breed Challenge Certificate for the best Saanen Female Goat, over 2 years old.

1768 **II. & R.N. for Champion.**[1]—MISS CECILY BOOTH, for **Springfield Lorelei 197,** born Feb. 27, 1932, kidded April 4, 1935; *s.* Springfield Lester 148, *d.* Springfield Lealty 73 *by* Gulden 37.

1769 **III.**—MISS MOSTYN OWEN, Spen House, Minskip, Boroughbridge, for **Dissington Snowball 214,** born Feb. 3, 1933, kidded March 16, 1935, bred by Mrs. R. W. Rotherford, Ravensworth, Newcastle-on-Tyne; *s.* Dissington Monderstrike 186, *d.* Didgemere Snowflake 152 *by* Ridgeway Ruric 112.

1770 **R.N.**—DR. C. S. STRAVENSON, Felix House, Middleton St. George, Co. Durham, for **Springfield Vassavassi.**

Class 240.—*British Saanen Female Goats, in-milk, any age.*

1775 **I., R.N. for Champion,**[2] **R.N. for Champion**[3] **& Champion.**[4]—MISS MOSTYN OWEN, Spen House, Minskip, Boroughbridge, for **Mostyn Matchless 343,** born March 20, 1932, kidded April 6, 1934; *s.* Mostyn Mariposa 280, *d.* Mostyn Melba 9041 *by* Didgemere Aristocrat 8207.

1773 **II. & R.N. for Champion.**[4]—MISS MOSTYN OWEN, for **Mostyn Marigold 165,** born Feb. 15, 1928, kidded March 15, 1934, bred by Mrs. Mostyn Owen, Boroughbridge; *s.* Didgemere Aristocrat 8207, *d.* Classic Pandora 1st 4891 *by* Prophet of Bashley 3775.

1771 **III.**—MRS. KNIGHT, Highfield House, Durham, for **Springfield Colleen 341,** born Feb. 17, 1932, kidded Feb. 20, 1935, bred by Miss Cecily Booth, Yore Croft, Ripon *s.* Springfield Loyalty 74, *d.* Springfield Unity 6370 *by* Feltham Seigfried 41.

Class 241.—*British Alpine Female Goats, in-milk, any age.*

1778 **I. & Champion.**[5]—MRS. W. A. STIRLING, Nussteads, Polstead, Suffolk, for **Bitterne Domino 286,** born March 17, 1933, kidded March 15, 1935, bred by Miss Barnaby, Abbeymead, Hants.; *s.* Didgemere Dragonfly 165, *d.* Homestall Domino 6730 *by* Homestall Dunkeld 4767.

1779 **II. & R.N. for Champion.**[5]—MRS. W. A. STIRLING, for **Didgemere Petunia 262,** born April 13, 1931, kidded March 11, 1935, bred by Mrs. Abbey, Downe Hall, Roydon; *s.* Didgemere Dago 66, *d.* Didgemere Dingus 8828 *by* Pan of Bashley 8055.

1777 **III.**—MRS. MORCOM, Clock House, Bromsgrove, for **Cornish Pitch 233,** born Feb. 18, 1933, kidded March 27, 1935; *s.* Pleaser of Bashley 9571, *d.* Cornish Catch 8418 *by* Raydon Benedict 6646.

1781 **R.N.**—MRS. W. A. STIRLING, for **Twinstead Threepennybit.**

Class 242.—*Anglo-Nubian Female Goats, in-milk, any age.*

1785 **I. & Champion.**[6]—MRS. HENDY, Etherley, Bishop Auckland, for **Etherley Della 2148,** born Feb. 1, 1932, kidded Jan. 17, 1935; *s.* Sadberge Swale 2012, *d.* Etherley Dawn 1922 *by* Etherley Jock 1746.

1783 **II.**—J. R. EGERTON, Malpas Cottage, Rushmere, Ipswich, for **Malpas Merllees 2147,** born Feb. 16, 1932, kidded May 27, 1935; *s.* Hoveton Freckle 1873, *d.* Malpas Magnolia *by* Hoveton Friar 1874.

Class 243.—*British Toggenburg or British Female Goats, in-milk, any age.*

1791 **I., Champion**[2] **& Champion.**[3]—MRS. MORCOM, Clock House, Bromsgrove, for **Cornish Saint 166,** British Toggenburg, born March 18, 1932, kidded June 6, 1934; *s.* Fryston Sansovino 567, *d.* Cornish Puritan 8936 *by* Priest of Bashley 6926.

1788 **II.**—MRS. HENDY, Etherley, Bishop Auckland, for **Broadwood Valentine 108,** British Toggenburg, born Feb. 14, 1930, kidded March 24, 1935, bred by John Hogg, Broadwood, Frosterley; *s.* Broadwood Chancellor 9107, *d.* Broadwood Bluebell 8231 *by* Pytchley Belzebub 5804.

1790 **III.**—MRS. MORCOM, for **Cornish Praline 161,** British Toggenburg, born Feb. 27, 1933, kidded March 31, 1935; *s.* Pleaser of Bashley 9571, *d.* Cornish Saccharine 10802 *by* Fryston Sansovino 567.

1789 **R.N.**—MRS. MORCOM, for **Cornish Playful.**
H.C.—1792.

Class 244.—*Saanen or British Saanen Goatlings, over 1 but not exceeding 2 years old.*

1800 **I.**—GEORGE EDWARD WALSH, Main Street, East Ardsley, Wakefield, for **Ripton Sybil 262,** Saanen, born April 9, 1934; *s.* Springfield Luke 121, *d.* Didgemere Siren 182 *by* Didgemere Sidney 115.

1794 **II**—MISS CECILY BOOTH, Yore Croft, Ripon, for **Springfield Sandra 244,** Saanen, born March 4, 1934; *s.* Springfield Luke 121, *d.* Didgemere Salome 148 *by* Didgemere Sidney 115.

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[1] Breed Challenge Certificate for the best Saanen Female Goat, over 2 years old.
[2] Bronze Medal for the best Female Goat.
[3] Challenge Certificate for the best Female Goat over 2 years old that has borne a kid.
[4] Breed Challenge Certificate for the best British Saanen Female Goat, over 2 years old.
[5] Breed Challenge Certificate for the best British Alpine Female Goat, over 2 years old.
[6] Breed Challenge Certificate for the best Anglo-Nubian Female Goat over 2 years old.

1795 III.—MRS. KNIGHT, Highfield House, Durham, for **Gataere Primula 417**, British Saanen, born April 16, 1934; *s.* Springfield Samson 226, *d.* Theydon Periwinkle 299 *by* Ridgeway Ripper 194.

1798 R.N.—MISS MOSTYN OWEN, Spen House, Minskip, Boroughbridge, for **Mostyn Melanie.**

H.C.—1799.

Class 245.—*British Alpine Goatlings, over 1 but not exceeding 2 years old.*

1805 I. & R.N. for Champion.[1]—MRS. W. A. STIRLING, Nussteads, Polstead, Suffolk, for **Twinstead Trilby 298**, born March 11, 1934; *s.* Marlais Merlin 84, *d.* Twinstead Twin 184 *by* Didgemere Dragonfly 165.

1803 II.—MRS. HENDY, Etherley, Bishop Auckland, for **Etherley Veronica 11440**, born March 9, 1934; *s.* Didgemere Nigger 9141, *d.* Broadwood Valentine 9663 *by* Broadwood Chancellor 9107.

1806 III.—MRS. W. A. STIRLING, for **Twinstead Truthful 297**, born March 13, 1934; *s.* Marlais Merlin 84, *d.* Twinstead Tegus 191 *by* Didgemere Dragonfly 165.

1801 R.N.—MISS ALEXANDER, Byards Lodge, Knaresborough, for **Stockwell Harmony.**

Class 246.—*Anglo-Nubian Goatlings, over 1 but not exceeding 2 years old.*

1811 I.—A. ELLIOTT, Batts House, West Lane, Heighington, Darlington, for **Aycliffe Doreen 2329**, born March 27, 1934; *s.* Etherley Prince 2233, *d.* Aycliffe Dainty 2117 *by* Theydon Barber 1803.

1809 II.—J. R. EGERTON, Malpas Cottage, Rushmere, Ipswich, for **Malpas Mimosa 2311**, born Jan. 30, 1934; *s.* Garrochty Gaiters 2181, *d.* Malpas Magnolia 13 *by* Hoveton Friar 1874.

1808 III.—J. R. EGERTON, for **Malpas Merry 2309**, born Feb. 4, 1934; *s.* Garrochty Gaiters 2181, *d.* Malpas Merilees 2147 *by* Hoveton Freckle 1873.

1810 R.N.—J. R. EGERTON, for **Malpas Mimoya.**

Class 247.—*Toggenburg, British Toggenburg or British Goatlings, over 1 but not exceeding 2 years old.*

1814 I. & Champion.[1]—MISS MOSTYN OWEN, Spen House, Minskip, Boroughbridge, for **Mostyn Meecha 11496**, British, born April 6, 1934; *s.* Didgemere Actor 85, *d.* Mostyn Matchless 10588 *by* Mostyn Mariposa 280.

1815 II.—DR. C. S. STEAVENSON, Felix House, Middleton St. George, Co. Durham, for **Felix Jasmine 11481**, British, born March 20, 1934; *s.* Batchcott Musketoon 9234, *d.* Chailey Janet 186 *by* Ledbury Persimmon 9568.

1813 III.—MISS MARJORIE HENDERSON, The Riding, Hexham, for **Riding Thistlefern 11549**, British Toggenburg, born April 6, 1934; *s.* Syam of Weald 770, *d.* Riding Thistlefoam 10477 *by* Pytchley Demon 10068.

1812 R.N.—MISS ALEXANDER, Byards Lodge, Knaresborough, for **Stockwell Chorist.**

Class 248.—*Toggenburg, British Toggenburg, Saanen, British Saanen, or British Alpine Female Kids, not over 1 year old.*

1824 I.—MISS MOSTYN OWEN, Spen House, Minskip, Boroughbridge, for **Mostyn Malva 11987**, British Saanen, born March 17, 1935; *s.* Dissington Monderstrike 186, *d.* Mostyn Marshmallow 279 *by* Springfield Ulick 172.

1826 II.—DR. C. S. STEAVENSON, Felix House, Middleton St. George, Co. Durham, for **Felix Vervain 11969**, British Saanen, born Feb. 1, 1935; *s.* Didgemere Charles 523, *d.* Springfield Vassavassi 150 *by* Didgemere Bayard 128.

1817 III.—MISS CECILY BOOTH, Yore Croft, Ripon, for **Springfield Lorella 286**, Saanen, born April 4, 1935; *s.* Heddon Punchinello 78, *d.* Springfield Lorelei 197 *by* Springfield Lester 148.

1825 R.N.—DR. C. S. STEAVENSON, for **Felix Vera.**

H.C.—1818. C.—1821.

Class 249.—*Anglo-Nubian or British Female Kids, not over 1 year old.*

1827 II.—MISS ALEXANDER, Byards Lodge, Knaresborough, for **Stockwell Tsamba 12001**, British, born Jan. 19, 1935; *s.* Didgemere Singer 203, *d.* Stockwell Tsarina 9648 *by* Didgemere Aristocrat 105.

Specials.[2]—I., £5, MRS. HENDY; II., £2, MISS MARJORIE HENDERSON.

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[1] Bronze Medal for the best Goatling.

[2] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham, for most points awarded in a combination of entries in the Goat Classes.

Milk Yield Classes.

Class 250.—*Milk Yield Class, Quality, open to animals entered in Classes 238 to 243.*

1773 I., Champion[1] & (with 1814) Champion.[2]—MISS MOSTYN OWEN, for Mostyn Marigold. (See Class 240.)
1783 II. & Champion.[3]—J. R. EGERTON, for Malpas Merilees. (See Class 242.)
1769 III.—MISS MOSTYN OWEN, for Dissington Snowball. (See Class 239.)
1791 IV. & R.N. for Champion.[1]—MRS. MORCOM, for Cornish Saint. (See Class 243.)
1775 V. & Champion.[4]—MISS MOSTYN OWEN, for Mostyn Matchless. (See Class 240.)
1781 R.N. & Champion.[5]—MRS. W. A. STIRLING, Nussteads, Polstead, Suffolk, for Twinstead Threepennybit 287, born March 18, 1933, kidded March 13, 1935; *s.* Didgemere Dragonfly 165, *d.* Twinstead Tuppence 10414 *by* Didgemere Angus 7161.
1766 H.C. & (with 1794) R.N. for Champion.[2]—MISS MARJORIE HENDERSON, for Didgemere Salome. (See Class 239.)
1768 Champion.[6]—MISS CECILY BOOTH, for Springfield Lorelei. (See Class 239.)
1777 R.N. for Champion.[5]—MRS. MORCOM, for Cornish Pitch. (See Class 241.)
H.C.—1789.

Class 251.—*Mild Yield Class, Quantity, open to animals entered in Classes 238 to 243.*

1773 I.—MISS MOSTYN OWEN, for Mostyn Marigold. (See Class 240.)
1787 II.—J. R. EGERTON, Malpas Cottage, Rushmere, Ipswich, for Malpas Magna 10285, British, born April, 17, 1931, kidded March 6, 1935; *s.* Springfield Luke 131, *d.* Worlington Wavey 133 *by* Springfield Fortuity 88.
1783 III.—J. R. EGERTON, for Malpas Merilees. (See Class 242.)
1791 IV.—MRS. MORCOM, for Cornish Saint. (See Class 243.)
1769 V.—MISS MOSTYN OWEN, for Dissington Snowball. (See Class 239.)
1779 R.N.—MRS. W. A. STIRLING, for Didgemere Petunia. (See Class 241.)
H.C.—1766, 1778, 1781, 1790.

SHEEP.

Unless otherwise stated, the Prizes in each Class for Sheep are: First Prize, £10; Second Prize, £5; Third Prize, £3; Fourth Prize, £2; Fifth Prize, £1.

Oxford Downs.

Class 252.—*Oxford Down Shearling Rams.*

1834 I. & R.N. for Champion,[7] & 1833 II.—H. W. STILGOE, The Grounds, Adderbury, Banbury.
1832 III.—NORMAN J. LAMB, East Fleetham, Seahouses, Northumberland, for Royalty 12631, bred by W. F. G. Watts & Sons, Black Bourton, Oxford.
1840 IV.—G. H. WILLIS, Birdlip, Gloucester.
1829 R.N.—J. & R. HARRISON, Gainford Hall, Gainford, Darlington.
H.C.—1836. C.—1835.

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[1] Challenge Certificate for the best Dual Purpose Goat, over 2 years old, that has borne a kid.
[2] The "Dewar" Challenge Cup for the exhibitor showing a Female Goat in-milk, and a Goatling, under certain conditions.
[3] The "Pomeroy" Challenge Cup for the Anglo-Nubian Goat, entered in the Anglo-Nubian section of the Society's Herd Book, gaining the highest number of points in the Milking Classes.
[4] The "Chamberlain" Challenge Cup for the British Saanen Goat gaining the highest number of points in Inspection and Milking. The goat must be bred by exhibitor, entered in the British Saanen section of the Herd Book, and have obtained an award in the Inspection Class.
[5] The "Abbey" Challenge Cup for the British Alpine Goat gaining the highest number of points in Inspection and Milking. The goat must be bred by exhibitor, entered in the British Alpine section of the Herd Book, and have obtained an award in the Inspection Class.
[6] The "Saanen" Challenge Cup for the Saanen Goat gaining the highest number of points in Inspection and Milking under certain conditions.
[7] The "Fernham" Silver Challenge Cup given through the Oxford Down Sheep Breeders' Association for the best Male exhibit.

Class 253.—*Oxford Down Ram Lambs.*

1848 I., Champion[1] & Champion,[2] & 1847 II.—W. F. G. WATTS & SONS, Hill Farm, Elsfield, Oxford.
1849 III.—G. H. WILLIS, Birdlip, Gloucester.
1846 R.N.—H. W. STILGOE, The Grounds, Adderbury, Banbury.
H.C.—1842. C.—1845.

Class 254.—*Three Oxford Down Ram Lambs.*

1856 I.—G. H. WILLIS, Birdlip, Gloucester.
1855 II.—W. F. G. WATTS & SONS, Hill Farm, Elsfield, Oxford.
1850 III.—LAWRENCE B. AKERS, Litchfield Farm, Enstone, Oxford.
1852 R.N.—HOBBS & DAVIS, Kelmscott, Lechlade.
H.C.—1854. C.—1851.

Class 255.—*Three Oxford Down Shearling Ewes.*

1857 I., R.N. for Champion,[2] & Champion.[3]—HOBBS & DAVIS, Kelmscott, Lechlade.
1858 II.—H. W. STILGOE, The Grounds, Adderbury, Banbury.
1860 III.—G. H. WILLIS, Birdlip, Gloucester.

Class 256.—*Three Oxford Down Ewe Lambs.*

1866 I., & R.N. for Champion[3] & 1865 II.—W. F. G. WATTS & SONS, Hill Farm, Elsfield, Oxford.
1862 III.—E. G. CLIFFORD, Manley Farm, Quenington, Fairford, Glos.
1861 R.N.—LAWRENCE B. AKERS, Litchfield Farm, Enstone, Oxford.
H.C.—1867. C.—1863.
Specials.[4]—I., £5, NORMAN J. LAMB ; II., £2, J. & R. HARRISON.

Shropshires.[5]

Class 257.—*Shropshire Shearling Rams.*

1876 I., Champion[6] & Champion,[7] & 1875 III.—E. CRAIG TANNER, Eyton-on-Severn, Wroxeter, Shropshire.
1868 II. & R.N. for Champion.[6]—JOHN M. BELCHER, Tibberton Green, Wellington, Shropshire.
1873 R.N.—A. E. & W. EVERALL, Sherlowe, Wellington, Shropshire.
H.C.—1871, 1874.

Class 258.—*Shropshire Ram Lambs.*

1881 I.—E. CRAIG TANNER, Eyton-on-Severn, Wroxeter, Shropshire.
1877 II.—JOHN M. BELCHER, Tibberton Green, Wellington, Shropshire.
1878 III.—A. E. & W. EVERALL, Sherlowe, Wellington, Shropshire.
1880 R.N.—MAJOR J. N. RITCHIE, Tern, Wellington, Shropshire.

Class 259.—*Three Shropshire Ram Lambs.*

1882 I.—JOHN M. BELCHER, Tibberton Green, Wellington, Shropshire.
1885 II.—MAJOR J. N. RITCHIE, Tern, Wellington, Shropshire.
1884 III.—E. CRAIG TANNER, Eyton-on-Severn, Wroxeter, Shropshire.
1883 R.N.—A. E. & W. EVERALL, Sherlowe, Wellington, Shropshire.

Class 260.—*Shropshire Shearling Ewes.*

1892 I. & R.N. for Champion.[7]—MAJOR J. N. RITCHIE, Tern, Wellington, Shropshire.
1893 II. & 1894 IV.—E. CRAIG TANNER, Eyton-on-Severn, Wroxeter, Shropshire.
1886 III.—JOHN M. BELCHER, Tibberton Green, Wellington, Shropshire.
1890 R.N.—A. E. & W. EVERALL, Sherlowe, Wellington, Shropshire.
H.C.—1887, 1888.

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[1] The "Fernham" Silver Challenge Cup given through the Oxford Down Sheep Breeders' Association for the best Male exhibit.
[2] The "Birdlip" Silver Challenge Cup given through the Oxford Down Sheep Breeders' Association for the best exhibit.
[3] The "Broadwell" Silver Challenge Plate given through the Oxford Down Sheep Breeders' Association for the best Female exhibit.
[4] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham, for most points awarded in a combination of entries in the Oxford Down Classes.
[5] £15 towards these Prizes were given by the Shropshire Sheep Breeders' Association.
[6] Champion Silver Medal given by the Shropshire Sheep Breeders' Association for the best Ram or Ram Lamb in Classes 257 and 258.
[7] The "Hardwicke" Perpetual Silver Challenge Cup given through the Shropshire Sheep Breeders' Association for the best exhibit.

Class 261.—*Three Shropshire Ewe Lambs.*

1895 I.—JOHN M. BELCHER, Tibberton Green, Wellington, Shropshire.
1899 II.—E. CRAIG TANNER, Eyton-on-Severn, Wroxeter, Shropshire.
1898 III.—MAJOR J. N. RITCHIE, Tern, Wellington, Shropshire.
1896 R.N.—A. E. & W. EVERALL, Sherlowe, Wellington, Shropshire.

Southdowns.

Class 262.—*Southdown Two Shear Rams.*

1906 I. & R.N. for Champion.[1]—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for Aldenham 23rd of 1933.
1904 II.—LADY LUDLOW, Luton Hoo, Luton, for Luton Hoo 449 of 1933.
1902 III.—JOHN LANGMEAD & SONS, Northwood, Ford, Arundel, for Ford Cinder.
1901 R.N.—THE DUKE OF BEDFORD, K.G., Woburn Abbey, Bletchley, for Woburn Amber.
H.C.—1907.

Class 263.—*Southdown Shearling Rams.*

1921 I., Champion[1] & Champion,[2] & 1922 R.N.—MRS. V. G. STRIDE, Head Hone Farm, Lidsey, Bognor Regis.
1913 II.—JOHN LANGMEAD & SONS, Northwood, Ford, Arundel.
1915 III.—LADY LUDLOW, Luton Hoo, Luton.
1917 IV., & 1918 V.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford.
H.C.—1909. C.—1911.

Class 264.—*Southdown Ram Lambs.*[3]

1930 I.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford.
1933 II.—MRS. V. G. STRIDE, Head Hone Farm, Lidsey, Bognor Regis.
1931 III., & 1932 IV.—WILLIAM H. PITTS, Woodhorn, Oving, Chichester.
1924 V.—THE EARL OF DERBY, K.G., Hatchfield Farm, Newmarket.
1928 R.N.—LADY LUDLOW, Luton Hoo, Luton.
H.C.—1934. C.—1929.

Class 265.—*Three Southdown Shearling Rams.*[3]

1938 I.—JOHN LANGMEAD & SONS, Northwood, Ford, Arundel.
1940 II.—LADY LUDLOW, Luton Hoo, Luton.
1941 III.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford.
1942 R.N.—WILLIAM H. PITTS, Woodhorn, Oving, Chichester.
H.C.—1937. C.—1936.

Class 266.—*Three Southdown Ram Lambs.*

1952 I.—WILLIAM H. PITTS, Woodhorn, Oving, Chichester.
1951 II.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford.
1953 III.—MRS. V. G. STRIDE, Head Hone Farm, Lidsey, Bognor Regis.
1947 R.N.—W. E. H. HEBBLETHWAITE, Upper Swell, Stow-on-the-Wold, Cheltenham.
H.C.—1948. C.—1945.

Class 267.—*Three Southdown Shearling Ewes.*

1957 I., R.N. for Champion[2] & Champion.[4]—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford.
1958 II.—MRS. V. G. STRIDE, Head Hone Farm, Lidsey, Bognor Regis.
1954 III.—JOHN LANGMEAD & SONS, Northwood, Ford, Arundel.
1955 R.N.—LADY LUDLOW, Luton Hoo, Luton.

Class 268.—*Three Southdown Ewe Lambs.*

1962 I. & R.N. for Champion.[4]—JOHN LANGMEAD & SONS, Northwood, Ford, Arundel.
1968 II.—MRS. V. G. STRIDE, Head Hone Farm, Lidsey, Bognor Regis.
1967 III.—WILLIAM H. PITTS, Woodhorn, Oving, Chichester.
1966 IV.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford.
1960 R.N.—THE EARL OF DERBY, K.G., Hatchfield Farm, Newmarket.
H.C.—1961. C.—1959, 1964.

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[1] Champion Gold Medal, or £10 10s. in cash, given by the Southdown Sheep Society for the best Ram or Ram Lamb in Classes 262 to 264.
[2] The "Northumberland" Perpetual Silver Challenge Cup given through the Southdown Sheep Society for the best exhibit.
[3] Prizes, except Fourth and Fifth, given by the Southdown Sheep Society.
[4] Champion Silver Medal, or £1 in cash, given by the Southdown Sheep Society for the best Pen of Ewes or Ewe Lambs.

Hampshire Downs.

Class 269.—*Hampshire Down Shearling Rams.*

1971 I.—MAJOR V. S. BLAND, The Warren, Aldbourne, Marlborough.
1969 II.—THE EXORS. OF THE LATE J. H. BENYON, Englefield House, Reading, for ram, bred by J. H. Benyon.
1974 III.—P. C. TORY, Shapwick, Blandford.
H.C.—1973. C.—1972.

Class 270.—*Hampshire Down Ram Lambs.*

1979 I.—E. CLIFTON-BROWN, Burnham Grove, Burnham, Bucks.
1975 II.—THE EXORS. OF THE LATE J. H. BENYON, Englefield House, Reading, for ram lamb, bred by J. H. Benyon.
1977 III.—MAJOR V. S. BLAND, The Warren, Aldbourne, Marlborough.
H.C.—1983. C.—1980.

Class 271.—*Three Hampshire Down Ram Lambs.*

1988 I.—E. CLIFTON-BROWN, Burnham Grove, Burnham, Bucks.
1991 II.—A. THOMAS LOYD, Lockinge House, Wantage.
1986 III.—THE EXORS. OF THE LATE J. H. BENYON, Englefield House, Reading, for ram lambs, bred by J. H. Benyon.
1987 R.N.—MAJOR V. S. BLAND, The Warren, Aldbourne, Marlborough.
H.C.—1992. C.—1990.

Class 272.—*Three Hampshire Down Shearling Ewes.*

1994 I. & 1993 II.—E. CLIFTON-BROWN, Burnham Grove, Burnham, Bucks.

Class 273.—*Three Hampshire Down Ewe Lambs.*

1997 I. & Champion.[1]—E. CLIFTON-BROWN, Burnham Grove, Burnham, Bucks.
1995 II. & R.N. for Champion.[1]—THE EXORS. OF THE LATE J. H. BENYON, Englefield House, Reading, for ewe lambs, bred by J. H. Benyon.
1999 III.—A. THOMAS LOYD, Lockinge House, Wantage.
2000 R.N.—P. C. TORY, Shapwick, Blandford.
H.C.—1996. C.—1998.

Suffolks.

Class 274.—*Suffolk Two Shear Rams.*

2002 I. & R.N. for Champion.[2]—JOHN R. KEEBLE & SON, Brantham Hall, Manningtree, for Brantham Lampard 4th 23184.
2003 II.—STUART PAUL, Kirton Lodge, Ipswich, for Kirton John 23255.

Class 275.—*Suffolk Shearling Rams.*

2010 I.—STUART PAUL, Kirton Lodge, Ipswich, for Kirton Johnson.
2007 II.—HOLLESLEY FARM (L.C.C.), Hollesley, Woodbridge, for Colony Field Marshal 2nd.
2013 III.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for Wratting A 1 23748.
2011 R.N.—STUART PAUL.
H.C.—2012. C.—2009.

Class 276.—*Suffolk Ram Lambs.*

2021 I.—JOHN R. KEEBLE & SON, Brantham Hall, Manningtree.
2023 II., & Special I., £3.[3]—SIR PRINCE PRINCE-SMITH, BART., Southburn, Driffield.
2019 III.—HOLLESLEY FARM (L.C.C.), Hollesley, Woodbridge.
2025 IV.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill.
2022 V.—STUART PAUL, Kirton Lodge, Ipswich.
2024 R.N. & Special II., £2.[3]—J. P. ROSS-TAYLOR, Mungoswalls, Duns.
2027 R.N. for Specials.[3]—J. COLIN SINCLAIR, Mardon, Cornhill-on-Tweed.
C.—2017.

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[1] Champion Prize of £10 given by the Hampshire Down Sheep Breeders' Association for the best exhibit.
[2] Perpetual Challenge Plate and £5 in cash given by the Suffolk Sheep Society for the best exhibit.
[3] Special Prizes given by the Suffolk Sheep Society for the best Ram Lambs in Class 276 entered by Exhibitors resident north of the Humber.

Class 277.—*Three Suffolk Ram Lambs.*[1]

2033 I.—John R. Keeble & Son, Brantham Hall, Manningtree.
2030 II.—The Earl of Ellesmere, Stetchworth Park, Newmarket.
2031 III.—Hollesley Farm (L.C.C.), Hollesley, Woodbridge.
2036 R.N.—Sir Prince Prince-Smith, Bart., Southburn, Driffield.
H.C.—2035. C.—2039.

Class 278.—*Three Suffolk Ram Lambs, untrimmed.*[1]

2045 I.—John R. Keeble & Son, Brantham Hall, Manningtree.
2044 II.—The Earl of Ellesmere, Stetchworth Park, Newmarket.
2048 III.—Frank Sainsbury, Blunts Hall, Little Wratting, Haverhill.
2043 R.N.—R. H. Brittain, Gulpher Hall, Felixstowe.
H.C.—2047.

Class 279.—*Three Suffolk Shearling Ewes.*

2053 I. & Champion.[2]—Stuart Paul, Kirton Lodge, Ipswich.
2050 II.—The Earl of Ellesmere, Stetchworth Park, Newmarket.
2051 III.—Hollesley Farm (L.C.C.), Hollesley, Woodbridge.
2055 R.N.—Frank Sainsbury, Blunts Hall, Little Wratting, Haverhill.
H.C.—2052. C.—2054.

Class 280.—*Three Suffolk Ewe Lambs.*

2061 I.—John R. Keeble & Son, Brantham Hall, Manningtree.
2060 II.—Hollesley Farm (L.C.C.), Hollesley, Woodbridge.
2062 III.—Stuart Paul, Kirton Lodge, Ipswich.
2064 R.N.—Frank Sainsbury, Blunts Hall, Little Wratting, Haverhill.
2063 Special II., £2.[3]—Sir Prince Prince-Smith, Bart., Southburn, Driffield.
H.C.—2059. C.—2063.

Class 281.—*Three Suffolk Ewe Lambs, untrimmed.*[1]

2069 I. & Special I., £3.[3]—J. P. Ross-Taylor, Mungoswalls, Duns.
2068 II.—John R. Keeble & Son, Brantham Hall, Manningtree.
2067 III.—The Earl of Ellesmere, Stetchworth Park, Newmarket.
2066 R.N.—R. N. Brittain, Gulpher Hall, Felixstowe.
2071 R.N. for Specials.[3]—J. Colin Sinclair, Mardon, Cornhill-on-Tweed.
H.C.—2070. C.—2071.
Cup.[4]—John R. Keeble & Son.
R.N. for Cup[4].—Stuart Paul.
Special, I.[5]—J. Colin Sinclair.

Dorset Downs.

Class 282.—*Dorset Down Rams, Shearling and upwards.*

2072 I.—Mrs. Lionel de Rothschild, Exbury House, Southampton, for ram born in 1934, bred by Hooper Bros., Newburgh, Dorchester.
2076 II.—John Joyce, Preston Bowyer Farm, Milverton, for ram born in 1934.
2073 III.—The Earl of Elgin, K.T., C.M.G., Broomhall, Dunfermline, for ram born in 1933, bred by P. & C. Seward, Weston, Petersfield.

Class 283.—*Dorset Down Ram Lambs.*[6]

2078 I. & R.N. for Champion[7] & 2077 II.—Mrs. Lionel de Rothschild, Exbury House, Southampton.
2081 III.—John Joyce, Preston Bowyer Farm, Milverton.

Class 284.—*Dorset Down Shearling Ewes.*

2083 I. & Champion,[7] & 2082 II.—Mrs. Lionel de Rothschild, Exbury House, Southampton.
2086 III.—John Joyce, Preston Bowyer Farm, Milverton.

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[1] Prizes given by the Suffolk Sheep Society.
[2] Perpetual Challenge Plate and £5 in cash given by the Suffolk Sheep Society for the best exhibit.
[3] Special Prizes given by the Suffolk Sheep Society for the best Pens of Ewe Lambs in Classes 280 and 281 entered by Exhibitors resident north of the Humber.
[4] The "Southburn" Silver Challenge Cup given through the Suffolk Sheep Society for the most points awarded in a combination of entries.
[5] Special Prize given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham, for most points awarded in a combination of entries in the Suffolk Sheep Classes.
[6] Prizes given by the Dorset Down Sheep Breeders' Association.
[7] Champion Prize of £5 given by the Dorset Down Sheep Breeders' Association for the best exhibit.

Dorset Horns.

Class 285.—*Dorset Horn Ram Lambs, born on or after October* 1, 1934.[1]

2091 I. & Champion,[2] 2092 II., & 2093 III.—W. RUPERT TORY, Clenstone Manor, Blandford.

2088 R.N.—THE EARL OF ELGIN, K.T., C.M.G., Broomhall, Dunfermline.
H.C.—2090.

Class 286.—*Two Dorset Horn Shearling Ewes, born on or after October* 1, 1933.

2097 I. & 2098 II.—W. RUPERT TORY, Clenstone Manor, Blandford.
2096 III.—CLIFFORD PERCY LOVELL, Barton Farm, Cerne Abbas, Dorchester.
2095 R.N.—THE EARL OF ELGIN, K.T., C.M.G., Broomhall, Dunfermline.

Class 287.—*Two Dorset Horn Ewe Lambs, born on or after October* 1, 1934.

2101 I. & R.N. for Champion,[2] & 2100 II.—W. RUPERT TORY, Clenstone Manor, Blandford.
2099 III.—THE EARL OF ELGIN, K.T., C.M.G., Broomhall, Dunfermline.

Wiltshire Horns.

Class 288.—*Wiltshire Horn Rams, Two Shear and upwards.*[3]

2103 I. & Champion.[4]—ALAN GOWLING, Snowford Hall, Leamington Spa, for Snowford Sunbeam, born in 1932.
2104 II.—W. B. SOUTHERNWOOD & SON, Gubblecote, Tring, Herts., for Yelvertoft Surprise No. 1 3399, born in 1923, bred by W. Evans, Yelvertoft, Rugby.

Class 289.—*Wiltshire Horn Shearling Rams.*

2105 I.—H. ATTERBURY, Sharley Cop, Ravensthorpe, Northampton, for Chymedd King 3768, bred by J. H. Parry Jones, Cae Mawr, Llanerchymedd.
2107 II.—ALAN GOWLING, Snowford Hall, Leamington Spa, for Kislingbury Surprise, bred by P. C. Smith, Kislingbury Grange, Northampton.

Class 290.—*Two Wiltshire Horn Shearling Ewes.*

2108 I. & R.N. for Champion.[4]—BRODIE BROS., Brockhall, Flore, Northampton.
2110 II.—W. B. SOUTHERNWOOD & SON, Gubblecote, Tring, Herts.
2109 III.—WILLIAM EVANS, The Orchards, Yelvertoft, Rugby.

Ryelands.

Class 291.—*Ryeland Rams, Two Shear and upwards.*

2111 I.—T. W. MONTAGUE PERKINS, Ufton Court, Holme Lacy, Hereford, for Holme Lacy Legacy 3142, born in 1933.
2112 II.—DAVID J. THOMAS, Monachty, Abergavenny, for Thomas's Rosette 3180, born in 1933.

Class 292.—*Ryeland Shearling Rams.*

2113 I. & Champion.[5]—DAVID J. THOMAS, Monachty, Abergavenny, for Thomas's Realm.
2114 II. & R.N. for Champion.[5]—T. W. MONTAGUE PERKINS, Ufton Court, Holme Lacy, Hereford, for Holme Lacy Mars.
2115 III.—T. W. MONTAGUE PERKINS, for Holme Lacy Merchant 2nd.
2116 R.N.—T. W. MONTAGUE PERKINS, for Holme Lacy Monk.

Class 293.—*Three Ryeland Ram Lambs.*

2120 I.—T. W. MONTAGUE PERKINS, Ufton Court, Holme Lacy, Hereford.
2121 II.—DAVID J. THOMAS, Monachty, Abergavenny.

Class 294.—*Three Ryeland Shearling Ewes.*

2122 I.—T. W. MONTAGUE PERKINS, Ufton Court, Holme Lacy, Hereford.

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[1] Prizes given by the Dorset Horn Sheep Breeders' Association.
[2] Champion Prize of £5 given by the Dorset Horn Sheep Breeders' Association for the best exhibit.
[3] Prizes given by the Wiltshire Horn Sheep Society.
[4] The "Pytchley" Silver Challenge Cup given through the Wiltshire Horn Sheep Society for the best exhibit.
[5] Silver Challenge Cup given through the Ryeland Flock Book Society for the best Shearling Ram.

Kerry Hills (Wales).

Class 295.—*Kerry Hill (Wales) Rams, Two Shear and upwards.*

2125 I. & Champion.[1]—THE DUKE OF WESTMINSTER, G.C.V.O., D.S.O., Eaton Home Farm, Aldford, Chester, for **Eaton Abbott 17920**, born in 1933.
2126 II. & R.N. for Champion.[1]—THOMAS WILLIAMS, The Gaer, Forden, Welshpool, for **Kerry Goalkeeper 18061**, born in 1933, bred by Ben Alderson, Glanmeheli, Kerry, Mont.
2123 III.—JOHN T. BEAVAN, Winsbury, Chirbury, Montgomery, for **Winsbury Plum 18406**, born in 1933.

Class 296.—*Kerry Hill (Wales) Shearling Rams.*

2127 I.—JOHN T. BEAVAN, Winsbury, Chirbury, Montgomery, for **Winsbury Quartermaster.**
2131 II.—THOMAS WILLIAMS, The Gaer, Forden, Welshpool, for **Gaer Peach 18541.**
2130 III.—H. C. PILKINGTON, Bryntanat, Llansantffraid, Mont., for **Tanatside Nimrod.**
2128 R.N.—JOHN T. BEAVAN, for **Winsbury Quack.**

Class 297.—*Kerry Hill (Wales) Ram Lambs.*

2132 I.—JOHN T. BEAVAN, Winsbury, Chirbury, Montgomery, for **Winsbury Rover.**
2135 II.—THE DUKE OF WESTMINSTER, G.C.V.O., D.S.O., Eaton Home Farm, Aldford, Chester, for **Eaton Comet.**
2136 III.—THOMAS WILLIAMS, The Gaer, Forden, Welshpool, for **Gaer Quaker.**
2133 R.N.—J. W. OWENS, Woodhouse, Shobdon, Leominster, for **Stockley Saddler.**

Class 298.—*Three Kerry Hill (Wales) Shearling Ewes.*

2137 I.—JOHN T. BEAVAN, Winsbury, Chirbury, Montgomery.
2139 II.—J. W. OWENS, Woodhouse, Shobdon, Leominster.
2142 III.—THE DUKE OF WESTMINSTER, G.C.V.O., D.S.O., Eaton Home Farm, Aldford, Chester.
2140 R.N.—H. C. PILKINGTON, Bryntanat, Llansantffraid, Montgomery.

Class 299.—*Three Kerry Hill (Wales) Ewe Lambs.*[2]

2143 I.—JOHN T. BEAVAN, Winsbury, Chirbury, Montgomery.
2147 II.—THOMAS WILLIAMS, The Gaer, Forden, Welshpool.
2145 III.—H. C. PILKINGTON, Bryntanat, Llansantffraid, Montgomery.
2144 R.N.—J. W. OWENS, Woodhouse, Shobdon, Leominster.

Clun Forest.

Class 300.—*Clun Forest Rams, Two Shear and upwards.*

2150 I.—T. E. GWILLIM, Ffostill, Talgarth, Brecon, for **Glen Briton 2404**, born in 1932, bred by Miss E. A. Rossiter, Glen Alva, Erwias Harold, Hereford.
2151 II.—D. POWELL, Lower Kimbolton, Leominster, for **Kimbolton Dandy 2717**, born in 1933.
2149 III.—R. EDWARDS, Staunton Old Court, Pembridge, for **Staunton Benefit 2511**, born in 1933.
2148 R.N.—DAVIES BROS., Fields End, Weobley, Herefordshire, for **Pitfield Joker.**
H.C.—2152.

Class 301.—*Clun Forest Shearling Rams.*

2154 I.—R. F. M. EVANS, Cholstrey Court, Leominster, for **Cholstrey K.6.**
2160 II.—D. POWELL, Lower Kimbolton, Leominster, for **Kimbolton Eric.**
2153 III.—DAVIES BROS., Fields End, Weobley, Herefordshire, for **Fields End Echo.**
2157 R.N.—WILLIAM ROBERTSON LYKE, Lawton Bury, Leominster.

Class 302.—*Clun Forest Ram Lambs.*

2161 I.—DAVIES BROS., Fields End, Weobley, Herefordshire, for **Fields End Faithfull.**
2163 II. & 2162 R.N.—R. F. M. EVANS, Cholstrey Court, Leominster.
2167 III.—D. POWELL, Lower Kimbolton, Leominster.

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[1] **Silver Challenge Cup given through the Kerry Hill (Wales) Flock Book Society for the best exhibit.**
[2] **Prizes given by the Kerry Hill (Wales) Flock Book Society.**

Class 303.—*Clun Forest Shearling Ewes.*

2173 I.—WILLIAM ROBERTSON LYKE, Lawton Bury, Leominster.
2174 II.—H. J. MARSH & SON, Bedstone, Bucknell, Shropshire.
2169 III.—DAVIES BROS., Fields End, Weobley, Herefordshire.

2170 R.N.—IVOR DANIEL GRIFFIN, Rumney Court, Cardiff.

Class 304.—*Clun Forest Ewe Lambs.*[1]

2178 I.—R. F. M. EVANS, Cholstrey Court, Leominster.
2181 II.—T. E. GWILLIM, Ffostill, Talgarth, Brecon.
2183 III.—H. J. MARSH & SON, Bedstone, Bucknell, Shropshire.
2177 IV.—DAVIES BROS., Fields End, Weobley, Herefordshire.

2182 R.N.—WILLIAM ROBERTSON LYKE, Lawton Bury, Leominster.

Lincolns.

Class 305.—*Lincoln Shearling Rams.*

2189 I. & Champion,[2] & 2188 III.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.
2187 II. & R.N. for Champion,[2] & 2186 R.N.—ERNEST ADDISON, Riby Granger, Stallingborough.

Class 306.—*Three Lincoln Shearling Rams.*

2194 I.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.
2192 II.—ERNEST ADDISON, Riby Grange, Stallingborough.
2195 III.—HAROLD JOHN SMITH, Lings Farm, Croxby, Caistor, Lincoln.

Class 307.—*Three Lincoln Ram Lambs.*

2197 I.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.
2199 II.—HAROLD JOHN SMITH, Lings Farm, Croxby, Caistor, Lincoln.
2196 III.—ERNEST ADDISON, Riby Grange, Stallingborough.

Class 308.—*Three Lincoln Ewe Lambs.*

2200 I.—ERNEST ADDISON, Riby Grange, Stallingborough.
2202 II. & 2201 III.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.

2204 R.N.—HAROLD JOHN SMITH, Lings Farm, Croxby, Caistor, Lincoln.

Leicesters.

Class 309.—*Leicester Shearling Rams.*

2210 I. & Champion,[3] & 2211 R.N.—R. MEGGINSON, Garton Field, Driffield.
2209 II. & R.N. for Champion.[3]—WILLIAM JORDAN, Eastburn, Driffield.
2207 III.—F. W. DENNIS, 43, Aberdeen Walk, Scarborough.
C.—2205.

Class 310.—*Leicester Ram Lambs.*

2222 I.—THE EXORS. OF THE LATE R. H. STOCKS, Haywold, North Dalton, Driffield.
2215 II.—JOHN T. ALLISON, Low House, Stanghow, Boosbeck, Yorkshire.
2217 III.—F. W. DENNIS, 43, Aberdeen Walk, Scarborough.

2221 R.N.—R. MEGGINSON, Garton Field, Driffield.
H.C.—2220.

Class 311.—*Leicester Shearling Ewes.*

2229 I. & 2228 III.—R. MEGGINSON, Garton Field, Driffield.
2226 II.—WILLIAM JORDAN, Eastburn, Driffield.

2225 R.N.—F. W. DENNIS, 43, Aberdeen Walk, Scarborough.
H.C.—2223.

Class 312.—*Leicester Ewe Lambs.*

2230 I.—JOHN T. ALLISON, Low House, Stanghow, Boosbeck, Yorkshire.
2235 II.—R. MEGGINSON, Garton Field, Driffield.
2236 III.—THE EXORS. OF THE LATE R. H. STOCKS, Haywold, North Dalton, Driffield.

2234 R.N.—WILLIAM JORDAN, Eastburn, Driffield.
H.C.—2231.

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[1] Prizes given by the Clun Forest Sheep Breeders' Society.
[2] Special Prize of £5 given by the Lincoln Longwool Sheep Breeders' Association for the best Shearling Ram in Class 305.
[3] Champion Prize of a Piece of Plate given by the Leicester Sheep Breeders' Association for the best exhibit.

Border Leicesters.

Class 313.—*Border Leicester Rams, Two Shear and upwards.*

2240 I.—W. ROBSON, Low Hedgeley, Powburn, Northumberland, for **Blink Bonny 10214**, born in 1933, bred by James Jeffrey, Deuchrie, Dunbar.
2239 II.—A. B. Howie, Eshott Brocks, Felton, Morpeth, for **Sandyknowe Select**, born in 1933, bred by T. & M. Templeton, Sandyknowe, Kelso.
2237 III.—R. C. CAMERON, Greenlawdean, Greenlaw, Berwickshire, for **Knock-on 10182**, born in 1933, bred by Robert Cross, Knockdon, Maybole.

Class 314.—*Border Leicester Shearling Rams.*

2243 I. & R.N. for Champion.[1]—R. C. CAMERON, Greenlawdean, Greenlaw, Berwickshire, for ram bred by D. G. Mackay, Upper Old Mill, Turriff.
2244 II.—R. C. CAMERON, for ram bred by John Lawson, Elsrickle Mains, Biggar.
2241 III.—R. C. CAMERON, for **Greenlaw Evertrue.**
2242 IV.—R. C. CAMERON, for **Greenlaw Piecemaster.**
2253 R.N.—JAMES HOWIE & SONS, Muirside, Dumfries.

Class 315.—*Border Leicester Ewes, Two Shear and upwards.*[2]

2259 I.—R. C. CAMERON, Greenlawdean, Greenlaw, Berwickshire, for ewe born in 1930, bred by George McDowall, Brairbrae, Stranraer.
2266 II.—JOHN YOUNG, Skerrington Mains, Hurlford, Ayrshire, for ewe born in 1931.
2262 III.—A. B. HOWIE, Eshott Brocks, Felton, Morpeth, for ewe born in 1933.
2265 R.N.—ROBERT WILSON, Dockrayrigg, Wigton.

Class 316.—*Border Leicester Shearling Ewes.*

2276 I. & Champion,[1] & 2275 III.—JOHN YOUNG, Skerrington Mains, Hurlford, Ayrshire.
2271 II.—A. B. HOWIE, Eshott Brocks, Felton, Morpeth.
2269 R.N.—CHARLES H. DICKIE, Wooperton, Northumberland.
Specials.[3]—I. £5, A. B. HOWIE ; II. £2, W. ROBSON.

Half-Breeds (Border Leicester and Cheviot).

Class 317.—*Half-bred Shearling Rams.*

2277 I.—THOMAS ARMSTRONG, East Cote, Hawick.
2278 II.—JOHN ELLIOT, Blackhaugh, Clovenfords, Selkirkshire.
2281 III.—J. WALTON, Roseden, Wooperton, Northumberland.

Class 318.—*Half-bred Ewes, Two Shear and upwards.*

2282 I.—A HUNTER, South Farm, Glanton, Northumberland, for ewe born in 1930.
2287 II.—GEORGE SORDY, Heckley High House, Alnwick, for ewe born in 1932.
2284 III.—A. HUNTER, for ewe born in 1932.

Class 319.—*Half-bred Shearling Ewes.*

2299 I.—J. WALTON, Roseden, Wooperton, Northumberland.
2296 II.—GEORGE SORDY, Heckley High House, Alnwick.
2297 III.—W. J. M. THOMPSON, Swarland East House, Felton, Morpeth, for ewe bred by Mr. Robinson, Snipe House, Alnwick.
2290 IV.—A. HUNTER, South Farm, Glanton, Northumberland.
Specials.[4]—I. £5, A. HUNTER ; II. £2, divided between GEORGE SORDY and J. WALTON.

Wensleydales.

Class 320.—*Wensleydale Rams, Two Shear and upwards.*

2300 I. & Champion.[5]—JOHN DARGUE, Burneside Hall, Kendal, for **Burneside Proud Champion**, born in 1933.
2301 II.—JOHN DARGUE, for **Leading Standard's Heir 4009**, born in 1933, bred by J. Dinsdale, Low Bolton, Redmire, Yorkshire.
2302 III.—JOHN A. WILLIS, Manor House, Carperby, Yorkshire, for **Carperby Matchless**, born in 1933.

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[1] Perpetual Silver Challenge Cup and a Gold Medal given by the Society of Border Leicester Sheep Breeders for the best Ram or Ewe.
[2] Prizes given by the Society of Border Leicester Sheep Breeders.
[3] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham, for most points awarded in a combination of entries in the Border Leicester Classes.
[4] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham, for most points awarded in a combination of entries in the Half-bred Sheep Classes.
[5] Silver Challenge Trophy and a Gold Medal given by the Wensleydale Longwool Sheep Breeders' Association for the best exhibit.

Class 321.—*Wensleydale Shearling Rams.*

2303 I.—JOHN DARGUE, Burneside Hall, Kendal.
2304 II.—JOHN W. GREENSIT, Holme-on-Swale, Thirsk.
2305 III.—JOHN PERCIVAL, Easthouse, Carperby, Yorkshire.
H.C.—2308.

Class 322.—*Three Wensleydale Shearling Rams.*

2309 I. & R.N. for Champion.[1]—JOHN DARGUE, Burneside Hall, Kendal.
2310 II.—JOHN W. GREENSIT, Holme-on-Swale, Thirsk.
2311 III.—JOHN PERCIVAL, Easthouse, Carperby, Yorkshire.

Class 323.—*Wensleydale Shearling Ewes.*

2312 I.—JOHN DARGUE, Burneside Hall, Kendal.
2313 II.—JOHN W. GREENSIT, Holme-on-Swale, Thirsk.
2318 III.—JOHN A. WILLIS, Manor House, Carperby, Yorkshire, for ewe bred by J. Fred Wood, Newsham Grange, Thirsk.
H.C.—2314.

Class 324.—*Wensleydale Yearling Ewes, shown in wool.*[2]

2319 I.—JOHN DARGUE, Burneside Hall, Kendal, for ewe bred by W. T. Milner & Sons, Slyne Hall, Lancaster.
2321 II.—JOHN PERCIVAL, Easthouse, Carperby, Yorkshire.
2323 III.—JOHN A WILLIS, Manor House, Carperby, Yorkshire, for ewe bred by J. Hargrave, Wath, Ripon.
H.C.—2320.

Kent or Romney Marsh.

Class 325.—*Kent or Romney Marsh Two Shear Rams.*

2327 I.—J. EGERTON QUESTED, The Firs, Cheriton, Kent, for Quested's 12 of 1933 77053.
2324 II.—E. W. BAKER, Parsonage Farm, Bekesbourne, Canterbury, for Renville No. 31 of 1933, bred by W. Miller, Renville, Canterbury.
2329 III.—ASHLEY STEVENS, Davington Hall, Faversham, for Luddenham 95 of 1933 77432.
C.—2325.

Class 326.—*Kent or Romney Marsh Shearling Rams.*

2332 I. & Champion.[3]—WILLIAM MILLER, Renville, Canterbury.
2331 II. & R.N. for Champion,[3] & 2330 R.N.—E. W. BAKER, Parsonage Farm, Bekesbourne, Canterbury.
2338 III. & 2336 IV.—J. EGERTON QUESTED, The Firs, Cheriton, Kent.
C.—2335, 2337, 2339.

Class 327.—*Three Kent or Romney Marsh Shearling Rams.*[4]

2348 I. £20 & 2347 III. £10.— J. EGERTON QUESTED, The Firs, Cheriton, Kent.
2344 II. £15.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.
2341 IV. £5.—E. W. BAKER, Parsonage Farm, Bekesbourne, Canterbury.
2349 R.N.—ASHLEY STEVENS, Davington Hall, Faversham.
H.C.—2343. C.—2346.

Class 328.—*Three Kent or Romney Marsh Ram Lambs.*

2350 I. & 2351 III.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.
2352 II. & 2353 R.N.—J. EGERTON QUESTED, The Firs, Cheriton, Kent.
H.C.—2354.

Class 329.—*Three Kent or Romney Marsh Shearling Ewes.*

2359 I. & Champion,[5] & 2360 III.—J. EGERTON QUESTED, The Firs, Cheriton, Kent.
2356 II.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.
2361 R.N.—ASHLEY STEVENS, Davington Hall, Faversham.
H.C.—2357.

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[1] Silver Challenge Trophy and a Gold Medal given by the Wensleydale Longwool Sheep Breeders' Association for the best exhibit.
[2] Prizes given by the Wensleydale Longwood Sheep Breeders' Association.
[3] Champion Prize of £10 10s. given by the Kent or Romney Marsh Sheep Breeders' Association for the best Ram in Classes 325 and 326.
[4] Prizes given by the Kent or Romney Marsh Sheep Breeders' Association.
[5] Champion Prize of £10 10s. given by the Kent or Romney Marsh Sheep Breeders' Association for the best Pen of Ewes or Ewe Lambs.

Class 330.—*Three Kent or Romney Marsh Ewe Lambs.*

2362 I. & R.N. for Champion,[1] & 2363 III.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.
2364 II.—J. EGERTON QUESTED, The Firs, Cheriton, Kent.
2366 R.N.—ASHLEY STEVENS, Davington Hall, Faversham.
H.C.—2365.

South Devons.

Classes 331 *and* 332.

[No Entries.]

Dartmoors.

Class 333.—*Dartmoor Rams, Shearling and upwards, shown out of wool.*

2368 I.—J. KNAPMAN & SONS, Thorne, Throwleigh, Okehampton, for **Chaddlehanger Jovial 4855**, born in 1932, bred by R. P. Luce, Chaddlehanger, Tavistock.
2369 II.—RICHARD PALMER LUCE, Lower Chaddlehanger, Tavistock, for **Chaddlehanger Kid 5007**, born in 1933.
2367 III.—GEORGE GLANFIELD, West Lane, Okehampton, for **Bullhornstone No. 29 4922**, born in 1934, bred by C. Mead, Bullhornstone, South Brent.
2370 R.N.—RICHARD PALMER LUCE, for **Chaddlehanger Lump.**

Class 334.—*Dartmoor Shearling Ewes, shown in wool.*

2373 I. & 2372 II.—RICHARD PALMER LUCE, Lower Chaddlehanger, Tavistock.
2371 III.—GEORGE GLANFIELD, West Lake, Okehampton.

Lonks.

Class 335.—*Lonk Rams, Shearling and upwards.*

2374 I.—HARRY HIGGIN, Black Moor Farm, Oxenhope, Keighley, for **Black Moor Peter 82**, born in 1933.
2375 II.—HARRY O. MITCHELL, Moorcroft. Oxenhope, Keighley, for **Black Moor Squire**, born in 1934, bred by H. Higgin, Black Moor Farm, Oxenhope.

Class 336.—*Lonk Shearling Ewes.*

2379 I.—HARRY O. MITCHELL, Moorcroft, Oxenhope, Keighley, for ewe bred by H. Higgin, Black Moor Farm, Oxenhope.
2380 II.—ROBERT PARKER, Houses-o'-th'-Hill, Whitworth, Rochdale, for **Black Moor Annie 2nd**, bred by H. Higgin, Black Moor Farm, Oxenhope, Keighley.

Swaledales.[2]

Class 337.—*Swaledale Rams, Two Shear and upwards.*

2384 I. & Champion.[3]—SIR FREDERICK MILBANK, BART., Barningham Park, Richmond, Yorks, for **East Stonesdale Ruby B.2117**, born in 1931, bred by J. N. Harker & Son, East Stonesdale, Keld, Richmond, Yorkshire.
2386 II.—JOHN LAWRENCE PEACOCK, Punchard House, Arkengarthdale, Richmond, Yorkshire, for **Punchard Colombo 2383**, born in 1933, bred by J. Peacock, Old Spital, Bowes, Darlington.
2382 III.—THOMAS W. GUY, Gilmonby Home Farm, Bowes, Darlington, for **Moss Ranger B2987**, born in 1933, bred by R. Harker, Arkengarthdale, Richmond, Yorks.
2381 R.N.—JOSEPH WILLIAM DENT, Fair View, Middleton-in-Teesdale, for **Active Lad.**

Class 338.—*Swaledale Shearling Rams.*

2392 I.—JOHN LAWRENCE PEACOCK, Punchard House, Arkengarthdale, Richmond, Yorks., for **Punchard Flamingo.**
2391 II.—SIR FREDERICK MILBANK, BART., Barningham Park, Richmond, Yorks.
2389 III.—THOMAS W. GUY, Gilmonby Home Farm, Bowes, Darlington, for **Gilmonby Prince.**
2387 R.N.—JOSEPH WILLIAM DENT, Fair View, Middleton-in-Teesdale, for **Jubilee Swell.**

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[1] Champion Prize of £10 10s. given by the Kent or Romney Marsh Sheep Breeders' Association for the best Pen of Ewes or Ewe Lambs.
[2] £10 towards these Prizes were given by the Swaledale Sheep Breeders' Association.
[3] Champion Prize of £5 given by the Swaledale Sheep Breeders' Association for the best exhibit.

Class 339.—*Swaledale Ewes, Two Shear and upwards.*

2394 I. & R.N. for Champion.[1]—THOMAS W. GUY, Gilmonby Home Farm, Bowes, Darlington, for ewe born in 1933.
2393 II.—JOSEPH WILLIAM DENT, Fair View, Middleton-in-Teesdale, for ewe born in 1931.
2397 III.—SIR FREDERICK MILBANK, BART., Barningham Park, Richmond, Yorks., for ewe born in 1932.
2399 R.N.—JOHN LAWRENCE PEACOCK, Punchard House, Arkengarthdale, Richmond, Yorks., for **Punchard Bright Eyes.**
H.C.—2398.

Class 340.—*Swaledale Shearling Ewes.*

2401 I.—THOMAS W. GUY, Gilmonby Home Farm, Bowes, Darlington.
2404 II. & 2405 III.—SIR FREDERICK MILBANK, BART., Barningham Park, Richmond, Yorks.
2400 R.N.—JOSEPH WILLIAM DENT, Fair View, Middleton-in-Teesdale, for **Heather Lass.**
H.C.—2402. C.—2406.

Herdwicks.

Class 341.—*Herdwick Rams, born in or before* 1933.[2]

2410 I.—WILLIAM WILSON, Herdwick View, Armathwaite Hall, Keswick, for **Derwent Grimison 6580**, born in 1929.
2407 II.—LORD LECONFIELD, Cockermouth Castle, Cumberland, for **Dash Delight 6578**, born in 1929.
2409 III.—RICHARD M. WILSON, Glencoyne, Ullswater, Penrith, for **Hatcliffe Champion**, born in 1932.

Class 342.—*Herdwick Rams, born in* 1934.

2413 I.—WILLIAM WILSON, Herdwick View, Armathwaite Hall, Keswick, for **Derwent Grimcrater.**
2411 II.—LORD LECONFIELD, Cockermouth Castle, Cumberland, for **Skiddaw Sportsman.**
2412 III.—RICHARD M. WILSON, Glencoyne, Ullswater, Penrith, for ram bred by J. Bell & Son, Riverside, Dockray, Penrith.

Class 343.—*Herdwick Ewes, born in* 1934.

2416 I.—WILLIAM WILSON, Herdwick View, Armathwaite Hall, Keswick, for **Derwent Rose Bud.**
2415 II.—RICHARD M. WILSON, Glencoyne, Ullswater, Penrith, for ewe bred by William Wilson, Herdwick View.
2414 III.—LORD LECONFIELD, Cockermouth Castle, Cumberland, for **Skiddaw Alice.**

Rough Fells.[3]

Class 344.—*Rough Fell Rams, Two Years and upwards.*

2419 I.—SIR S. H. SCOTT, BART., Yews, Windermere, for **Coming Event K. 233**, born in 1932.
2418 II.—J. T. POSTLETHWAITE, Riddings, Howgill, Lowgill, Kendal, for **Mill House Highlander S. 262**, born in 1933, bred by J. & E. Wilson, Millhouse, Middleton, Kirkby Lonsdale.
2417 III.—J. T. POSTLETHWAITE, for **Birkhaw General S. 193**, born in 1931, bred by G. Capstick, Birkhaw, Howgill, Sedbergh.

Class 345.—*Rough Fell Yearling Rams.*

2420 I.—SIR S. H. SCOTT, BART., Yews, Windermere, for **Dandy Roy.**
2421 II.—MATTHEW WALLING, Tarn Side, Crosthwaite, Kendal, for **Tarn Side Comet**, bred by G. Kirkbridge, Moorhouse Farm, Ulverston.

Class 346.—*Rough Fell Yearling Ewes.*

2423 I. & Champion.[4]—JOHN DARGUE, Burneside Hall, Kendal, for **Princess Lovely**, bred by J. T. Postlethwaite, Riddings, Howgill.
2422 II. & R.N. for Champion.[4]—JOHN DARGUE, for **Jubilee Princess**, bred by J. Hodgson, Lambrigg Park, Kendal.
2424 III.—SIR S. H. SCOTT, BART., Yews, Windermere, for **Dark Maid.**
2425 R.N.—SIR S. H. SCOTT, BART., for **Dora.**

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[1] Champion Prize of £5 given by the Swaledale Sheep Breeders' Association for the best exhibit.
[2] Prizes given by the Herdwick Sheep Breeders' Association.
[3] £5 towards these Prizes were given by the Rough Fell Sheep Breeders' Association.
[4] Champion Prize of £5 given by the Rough Fell Sheep Breeders' Association for the best exhibit.

Cheviots.[1]

Class 347.—*Cheviot Rams, Two Shear and upwards.*

2430 I.—ARTHUR ELLIOT, Hindhope, Jedburgh, for **Hounds Gentleman**, born in 1932.
2427 II.—WALTER S. DOUGLAS, Hindhope, Jedburgh, for ram born in 1933.
2432 III.—ROBERT T. ELLIOT, Chatto, Kelso, for **Last Link**, born in 1933, bred by the late G. Elliot, Brockdam, Chathill.

H.C.—2429, 2431, 2433.

Class 348.—*Cheviot Shearling Rams.*

2439 I. & R.N. for Champion.[2]—ROBERT T. ELLIOT, Chatto, Kelso.
2436 II.—ARTHUR ELLIOT, Hindhope, Jedburgh.
2438 III.—JOHN ELLIOT, Blackhaugh, Clovenfords, Selkirk.

H.C.—2434, 2435, 2437, 2440, 2442.

Class 349.—*Cheviot Ram Lambs.*

2450 I.—JOHN THOMSON, Bushelhill, Cockburnspath, for **Bushelhill Mascot.**
2444 II.—ARTHUR ELLIOT, Hindhope, Jedburgh.
2446 III.—JOHN ELLIOT, Blackhaugh, Clovenfords, Selkirk.

H.C.—2443, 2445, 2447, 2448, 2449.

Class 350.—*Cheviot Ewes, Two Shear and upwards.*

2454 I. & Champion.[2]—ARTHUR ELLIOT, Hindhope, Jedburgh, for ewe born in 1932.
2451 II.—THOMAS ARMSTRONG, East Cote, Hawick, for ewe born in 1933.
2452 III.—WALTER S. DOUGLAS, Hindhope, Jedburgh, for ewe born in 1931.

H.C.—2456.

Class 351.—*Cheviot Shearling Ewes.*

2464 I. & 2465 II.—ARTHUR ELLIOT, Hindhope, Jedburgh.
2462 III.—WALTER S. DOUGLAS, Hindhope, Jedburgh.

H.C.—2463.

Class 352.—*Cheviot Ewe Lambs.*

2472 I.—JOHN ELLIOT, Blackhaugh, Clovenfords, Selkirk.
2468 II.—THOMAS ARMSTRONG, East Cote, Hawick.
2473 III.—ROBERT T. ELLIOT, Chatto, Kelso.

H.C.—2469, 2474, 2475, 2476.
Specials.[3]—I., £5, ARTHUR ELLIOT; II., £2, WALTER S. DOUGLAS.

Black-Face Mountain.

Class 353.—*Black-face Mountain Rams, Two Shear and upwards.*

2478 I.—ARTHUR CAYLEY, Carham, Coldstream, for ram born in 1932, bred by Matthew Hamilton, Woolfords, Cobbishaw, Lanarkshire.
2479 II.—OCTAVIUS MONKHOUSE, Dene House, Wearhead, Co. Durham, for **Buleland Hill**, bred by Arthur Cayley, Carham, Coldstream.
2477 III.—WILLIAM CARRUTHERS, Low Stublie, Langley-on-Tyne, for **Prince Charley**, born in 1933, bred by Charles Cadzow, Weston, Dunsyre.

Class 354.—*Black-face Mountain Shearling Rams.*

2481 I. & 2482 II.—ARTHUR CAYLEY, Carham, Coldstream.
2483 III.—JOHN ROBSON, Newton, Tarset, Northumberland.
2480 R.N.—WILLIAM CARRUTHERS, Low Stublie, Langley-on-Tyne, for **Billy Boy.**

Class 355.—*Black-face Mountain Ewes, Two Shear and upwards.*

2486 I.—ARTHUR CAYLEY, Carham, Coldstream, for ewe born in 1932.
2484 II.—WILLIAM CARRUTHERS, Low Stublie, Langley-on-Tyne, for **The Dowager**, born in 1926, bred by W. Dobson.
2485 III.—WILLIAM CARRUTHERS, for **The Duchess**, born in 1933.

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[1] £10 towards these Prizes were given by the Cheviot Sheep Society.
[2] The "Borthwick" Challenge Cup given by the Cheviot Sheep Society for the best exhibit.
[3] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham, for most points awarded in a combination of entries in the Cheviot Classes.

Class 356.—*Black-face Mountain Shearling Ewes.*

2489 I.—WILLIAM CARRUTHERS, Low Stublie, Langley-on-Tyne, for ewe bred by A. Brown. Gateside.
2490 II. & 2491 R.N.—ARTHUR CAYLEY, Carham, Coldstream.
2488 III.—WILLIAM CARRUTHERS, for Wild Eyes.
Specials.[1]—I., £5, ARTHUR CAYLEY; II., £2, WILLIAM CARRUTHERS.

Welsh Mountain.

Class 357.—*Welsh Mountain Rams, Shearling and upwards.*

2497 I.—UNIVERSITY COLLEGE OF NORTH WALES, Bangor, for Snowdon G. 5 4929, born in 1933.
2493 II.—DENBIGHSHIRE EDUCATION AUTHORITY, Llysfasi Farm Institute, Ruthin, for (L.F.) G. 19 4712, born in 1933.
2496 III.—UNIVERSITY COLLEGE OF NORTH WALES, for Snowdon D. 57 4637, born in 1931.
2492 R.N.—DENBIGHSHIRE EDUCATION AUTHORITY, for (L.F.) G. 2.

Class 358.—*Three Welsh Mountain Shearling Ewes.*

2499 I. & 2498 III.—DENBIGHSHIRE EDUCATION AUTHORITY, Llysfasi Farm Institute, Ruthin.
2504 II. & 2502 R.N.—UNIVERSITY COLLEGE OF NORTH WALES, Bangor.

Black Welsh Mountain.

Class 359.—*Black Welsh Mountain Shearling Rams.*

2505 I.—MAJOR CLIVE BEHRENS, Swinton Grange, Malton, for Swinton Crystal.
2507 II.—MAJOR F. H. T. JERVOISE, Herriard Park, Basingstoke, for ram bred by Mrs. Jervoise.
2508 III.—MRS. JERVOISE, Herriard Park, Basingstoke.

Class 360.—*Three Black Welsh Mountain Shearling Ewes.*[2]

2509 I.—MAJOR CLIVE BEHRENS, Swinton Grange, Malton.
2511 II.—MAJOR F. H. T. JERVOISE, Herriard Park, Basingstoke, for ewe bred by Mrs. Jervoise.
2512 III.—MRS. JERVOISE, Herriard Park, Basingstoke.

PIGS.

The Prizes in each Class for Pigs are: First, £10; Second, £5; Third, £3; Fourth, £2; Fifth, £1.

[*The numbers in brackets refer to the Tattoo or Ear Numbers of the Animals.*]

Large Whites.

Class 361.—*Large White Boars, born in or before* 1933.

2527 I. Champion,[3] Special,[4] & R.N. for Champion.[5]—W. L. VAWSER, Regent Avenue, March, Cambs., for Spalding Banner 33rd 85391 (2107), born April 12, 1932, bred by Alfred W. White, Hillegom, Spalding; *s.* Spalding Banner 21st 72859, *d.* Spalding Superior 7th 196750 *by* Spalding Bob 11th 53617.

2526 II.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for Wratting King David 13th 91899 (744), born Jan. 26, 1933; *s.* Wratting King David 5th 78741, *d.* Creek Belle 78th 212472 *by* Westacre Bradbury 206th 70267.
2525 III.—WALTER W. RYMAN, Wall, Lichfield, for Wall King David 59th 91213 (5860), born Jan. 5, 1933; *s.* Wall King David 46th 81631, *d.* Packwood Brocade 37th 206562 *by* Wentworth Masterpiece 10th 70249.

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[1] Special Prizes given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham, for most points awarded in a combination of entries in the Black-Face Mountain Classes.
[2] Prizes given by the Black Welsh Mountain Sheep Breeders' Association.
[3] Champion Gold Medal, or £5 cash, given by the National Pig Breeders' Association for the best Large White Boar.
[4] Special Prize of Two Guineas given by the National Pig Breeders' Association for the best Large White Pig whose dam has qualified for registration in this Association's Advance Register of Fecundity.
[5] Silver Challenge Cup given by the National Pig Breeders' Association for the best Large White Pig.

2521 IV.—THE REV. E. A. DOUGLAS MORGAN, Trefonen Rectory, Oswestry, for **Bottesford Boy 22nd** 79687 (337), born Jan. 8, 1932, bred by D. R. Daybell & Son, Bottesford, Nottingham; *s.* Walton Boy 42nd 73357, *d.* Bottesford Buttercup 115th 178878 *by* Edmonton Bradbury 3rd 56491.
2523 V.—MRS. COLIN W. PRINCE & SON, New Inns Hotel Farm, Alsop-en-le-Dale, Ashbourne, for **Westacre Premier 3rd** 81889 (5195), born Oct. 11, 1931, bred by Alfred Lewis, Westacre, King's Lynn; *s.* Creek Premier 76087, *d.* Creek Belle 30th 193658 *by* Westacre Bradbury 206th 70267.

2517 R.N.—CAPT. A. J. ELDER, City Mills, Dunfermline, for **Aldenham Bradbury 25th.**
H.C.—2513.

Class 362.—*Large White Boars, born in* 1934, *before July* 1.

2529 I. & R.N. for Champion.[1]—CHIVERS & SONS, LTD., Histon, Cambridge, for **Tring Basil 3rd** 91029 (9), born Jan. 24, bred by H. W. Bishop, Park Hill Farm, Tring; *s.* Aldenham Basil 12th 75449, *d.* Histon Dainty Girl 96th 195090 *by* Histon Bob 26th 69133.
2543 II.—H. W. WHITE, Weston Hills, Spalding, for **Tydd Kingmaker 17th** 91069 (214), born Jan. 30, bred by A. B. Rose, Tydd; *s.* Melford Kingmaker 52nd 77147, *d.* Tydd Primrose 225876 *by* Amcotts Peter 2nd 70675.
2541 III.—COL. C. J. H. WHEATLEY, Berkswell Hall, Coventry, for **Tockwith Basil 3rd** 90871 (4259), born Jan. 14, bred by E. Thomlinson, Hall Farm, Hutton Wandesley; *s.* Histon Basil 6th 84389, *d.* Tockwith Blackberry 65th 225512 *by* Walton Boy 66th 78147.
2538 IV.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Wratting King David 23rd** 91917 (76), born Feb. 3; *s.* Wratting King David 5th 78741, *d.* Wratting Mana 4th 198260 *by* Wratting King David 2nd 62823.
2536 V.—WALTER W. RYMAN, Wall, Lichfield, for **Wall Majestic 18th** (6309), born Jan. 26; *s.* Wall Majestic 81651, *d.* Wall Ann 4th 207988 *by* Wall Lion 3rd 66141.

2533 R.N.—ERNEST HARDING, Packwood Grange, Dorridge, Birmingham, for **Packwood Recorder 30th.**
H.C.—2531. C.—2530, 2537.

Class 363.—*Large White Boars, born in* 1934, *on or after July* 1.[2]

2551 I.—JOHN W. HESP, Broad Oak, Sutton-on-Forest, York, for **Tockwith Major 19th** (4442), born July 6, bred by E. Thomlinson, Hall Farm, Hutton Wandesley, Marston; *s.* Tockwith Major 15th 85721, *d.* Aldenham Maid 10th 219092 *by* Aldenham Basil 12th 75449.
2564 II.—H. W. WHITE, Weston Hills, Spalding, for **Weston David 3rd** (558), born July 20; *s.* O.B.O. David 90101, *d.* Westacre Model 12th 226586 *by* Creek King David 79905.
2547 III.—LORD DARESBURY, C.V.O., Walton Hall, Warrington, for **Walton Jay 134th** (4615), born July 1; *s.* Walton Jay 58th 81761, *d.* Ford Belle 42nd 221478 *by* Tockwith Beaverbrook 5th 77899.
2558 IV.—WALTER W. RYMAN, Wall, Lichfield, for **Wall Turk 18th** (6595), born July 5; *s.* Histon Turk 49th 84509, *d.* Wall Champion Queen 10th 216144 *by* Wall Jay 27th 66101.
2552 V.—ALFRED LEWIS, Panworth Hall, Ashill, Thetford, for **Westacre Baronet 39th** (6408), born July 2; *s.* Spalding Bradbury 27th 85411, *d.* Wentworth Brocade 4th 197752 *by* Wentworth Masterpiece 2nd 66255.

2553 R.N.—ALFRED LEWIS, for **Westacre Baronet 70th.**
H.C.—2548. C.—2546, 2550.

Class 364.—*Large White Boars, born in* 1935.

2572 I.—LORD DARESBURY, C.V.O., Walton Hall, Warrington, for **Walton H. Jay** (5055) born Jan. 4; *s.* Handley Jay 11th 89037, *d.* Rodbaston Duchess 2nd 224688 *by* Walton Boy 53rd 73379.
2582 II.—ALFRED LEWIS, Panworth Hall, Ashill, Thetford, for **Westacre Broker 17th** (6625), born Jan. 12; *s.* Westacre Bradbury 943rd 91621, *d.* Westacre Belle 112th 216488 *by* Creek Premier 76087.
2571 III.—LORD DARESBURY, C.V.O., for **Walton Bradbury 15th** (4984), born Jan. 2; *s.* Spalding Bradbury 34th 90617, *d.* Handley Bashful Lady 110th 233658 *by* Wall Jay 107th 81623.
2591 IV.—JOHN SCHOLEY, Northfield House, Birkin, Ferrybridge, Yorks., for **Beal Hercules 89th** (1409), born Jan. 16; *s.* Walton Hercules 25th 81749, *d.* Moreton May 47th 206294 *by* Bourne Baldwin 52255.
2581 V.—ALFRED LEWIS, for **Westacre Bandmaster 17th** (6635), born Jan. 13; *s.* Walton Bandmaster 111th 91605, *d.* Weston Mary 6th 240036 *by* Westacre Bradbury 581st 81859.

2566 R.N.—A. H. COOPER, Lower Farm, Drointon, Stowe-by-Chartley, Stafford, for **Blithfield Lion 9th.**

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[1] Champion Gold Medal, or £5 cash, given by the National Pig Breeders' Association for the best Large White Boar.
[2] Prizes, except Fourth and Fifth, given by the National Pig Breeders' Association.

H.C.—2573, 2589. **C.**—2578, 2583, 2587.

2572, 2602, 2620, 2642 **Special I.**[1]—LORD DARESBURY, C.V.O., for **Walton H. Jay, Walton Queen Mary 44th, Walton Lassie 96th and Walton Queen Mary 73rd.**

2526, 2538, 2610, 2671 **Special II.**[1]—FRANK SAINSBURY, for **Wratting King David 13th, Wratting King David 23rd, Wratting Mana 15th and Wratting Empress 18th.**

2525, 2558, 2629, 2649 **R.N. for Specials.**[1]—WALTER W. RYMAN, for **Wall King David 59th, Wall Turk 18th, Wall Ann 19th, and Wall Champion Queen 40th.**

Class 365.—*Large White Breeding Sows, born in or before* 1933.

2610 **I., Champion**[2] **& Champion.**[3]—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Wratting Mana 15th 217182 (536)**, born Feb. 26, 1932, farrowed Feb. 9; *s.* Wratting King David 5th 78741, *d.* Wratting Mana 8th 217168 *by* Wratting Bradbury 5th 70491.

2602 **II. & R.N. for Champion.**[3]—LORD DARESBURY, C.V.O., Walton Hall, Warrington, for **Walton Queen Mary 44th 216376 (3214)**, born Jan. 5, 1932, farrowed March 6; *s.* Taunton Turk 25th 66009, *d.* Walton Queen Mary 7th 173376 *by* Dupplin Excellence 56389.

2600 **III.**—ERNEST A. CROOKES, Rose Cottage Farm, Cutthorpe, Chesterfield, for **Cutthorpe Model 4th 212632 (2949)**, born July 10, 1931, farrowed Jan. 22; *s.* Newhall Banner 72465, *d.* Whittingham Model 5th 197916 *by* Abberton Bindle 55623.

2599 **IV.**—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Beryl 320th 213610 (S. 985)**, born May 5, 1931, farrowed Feb. 14; *s.* Histon Wonder 76th 72087, *d.* Histon Beryl 179th 180448 *by* Histon Kitchener 2nd 56965.

2607 **V.**—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Tockwith Blackberry 51st 225538 (3581)**, born Feb. 29, 1932, farrowed Jan. 14, bred by E. Thomlinson, Hall Farm, Hutton Wandesley; *s.* Walton Boy 66th 78147, *d.* Tockwith Blackberry 8th 182368 *by* Packwood Prince Edward 57453.

2603 **R.N.**—CAPT. A. J. ELDER, City Mills, Dunfermline, for **Ballechin Betty.**

H.C.—2605. **C.**—2612.

Class 366.—*Large White Sows, born in* 1934, *before July* 1.

2639 **I.**—J. F. WRIGHT, Olton Farm, Solihull, for **Solihull Belle 5th 238008 (38)**, born Jan. 2; *s.* Pendley Jay 11th 85125, *d.* Wall Belle 3rd 226061 *by* Walton Lion 12th 73465.

2629 **II.**—WALTER W. RYMAN, Wall, Lichfield, for **Wall Ann 19th (6314)**, born Jan. 26 *s.* Wall Majestic 81651, *d.* Wall Ann 4th 207988 *by* Wall Lion 3rd 66141.

2620 **III.**—LORD DARESBURY, C.V.O., Walton Hall, Warrington, for **Walton Lassie 96th (1420)**, born March 1; *s.* Walton Boy 75th 78157, *d.* Walton Lassie 67th 216290 *by* Handley Bandmaster 7th 71803.

2621 **IV.**—W. HALLAS, Bank House Farm, Helsby, Warrington, for **Hallastone Beautiful 29th 233402 (3392)**, born Jan. 14; *s.* Hallastone Victor 37th 80295, *d.* Wall Beautiful 30th 226036 *by* Wall Jay 27th 66101.

2618 **V.**—ERNEST A. CROOKES, Rose Cottage Farm, Cutthorpe, Chesterfield, for **Cutthorpe Lady Dorothy 109th (3790)**, born Jan. 6; *s* Whittingham Victor 13th 78413, *d.* Histon Dorothy 25th 212850 *by* Wall Lion 19th 73343.

2632 **R.N.**—SHERRIFF & SONS, Lemsford, Welwyn Garden, Herts., for **Nashes Iris 3rd.**

H.C.—2626, 2634. **C.**—2622, 2633.

Class 367.—*Large White Sows, born in* 1934, *on or after July* 1.

2644 **I.**—W. HALLAS, Bank House Farm, Helsby, Warrington, for **Hallastone Belle 30th (3501)**, born July 19; *s.* Westacre Premier 3rd 81889, *d.* Hallastone Belle 17th 194782 *by* Wentworth Bradbury 29th 62597.

2642 **II.**—LORD DARESBURY, C.V.O., Walton Hall, Warrington, for **Walton Queen Mary 73rd (4609)**, born July 1; *s.* Walton Jay 58th 81761, *d.* Walton Queen Mary 43rd 216374 *by* Taunton Turk 25th 66009.

2641 **III.**—ERNEST A. CROOKES, Rose Cottage Farm, Cutthorpe, Chesterfield, for **Cutthorpe Queen 128th (4073)**, born Aug. 22; *s.* Tockwith King David 13th 85707, *d.* Cutthorpe Queen 95th 220962 *by* Newhall Banner 72465.

2654 **IV.**—J. F. WRIGHT, Olton Farm, Solihull, for **Solihull Bonetta 8th (88)**, born July 10; *s.* Solihull Scotsman 90567, *d.* Solihull Bonetta 3rd 238014 *by* Wall Security 81657.

2647 **V.**—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford, for **Aldenham Blackberry 11th (920)**, born July 11; *s.* Aldenham Bradbury 45th 87131, *d.* Tockwith Blackberry 51st 225538 *by* Walton Boy 66th 78147.

2649 **R.N.**—WALTER W. RYMAN, Wall, Lichfield, for **Wall Champion Queen 40th.**

H.C.—2653. **C.**—2643.

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[1] Special Prizes of a Cup or £10 cash (First Prize) and £5 (Second Prize) given by the National Pig Breeders' Association for the best groups of four Large White Pigs, bred by Exhibitor. One Boar (at least) had to be included in each group, and not more than one entry selected from any one Class.

[2] Silver Challenge Cup given by the National Pig Breeders' Association for the best Large White Pig.

[3] Champion Gold Medal, or £5 cash, given by the National Pig Breeders' Association for the best Large White Sow.

Class 368.—*Large White Sows, born in* 1935.

2663 I.—ERNEST HARDING, Packwood Grange, Dorridge, Birmingham, for **Packwood Queen Ann 16th (5096)**, born Jan. 7; *s.* Packwood Bar None 33rd 85167, *d.* Packwood Queen Anne 11th 236862 *by* Glebe Rock Sand 71615.
2665 II.—A. W. LEASON, Brook House Farm, Uttoxeter, for **Walton Queen Anne 2nd (4949)**, born Jan. 1, bred by Lord Daresbury, C.V.O., Walton Hall, Warrington; *s.* Walton Bandmaster 115th 91311, *d.* Berkswell Queen Anne 10th 219726 *by* Caldmore Turk 9th 75901.
2659 III.—LORD DARESBURY, C.V.O., Walton Hall, Warrington, for **Walton Queen Anne 3rd (4950)**, born Jan. 1; *s.* Walton Bandmaster 115th 91311, *d.* Berkswell Queen Anne 10th 219726 *by* Caldmore Turk 9th 75901.
2661 IV.—D. R. DAYBELL & SON, Bottesford, Nottingham, for **Bottesford Buttercup 204th (698)**, born Jan. 11; *s.* Spalding Bradbury 29th 85405, *d.* Bottesford Buttercup 196th 230154 *by* Walton Boy 42nd 73357.
2655 V.—A. H. COOPER, Lower Farm, Drointon, Stowe-by-Chartley, Stafford, for **Blithfield Marigold 11th (467)**, born Jan. 3; *s.* Marchington Lion 8th 89705, *d.* Blithfield Marigold 2nd 219902 *by* Blithfield King David 68329.

2660 R.N.—LORD DARESBURY, C.V.O., for **Walton Queen Anne 5th.**
H.C.—2671, 2679. C.—2662, 2668.
Special.[1]—I. £5, JOHN WHITFIELD, Earsdon Grange, Earsdon, Newcastle-on-Tyne.

Middle Whites.

Class 369.—*Middle White Boars, born in or before* 1933.

2684 I. **Champion**[2], **Champion**[3] **& Special.**[4]—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Marmion 6th 79067 (142)**, born July 27, 1931; *s.* Fordon Marmion 74061, *d.* Histon Rosebud 43rd 186808 *by* Hammonds Herald 44353.
2683 II.—W. W. BUCKLE, Old Lane Farm, Colton, Tadcaster, for **Fulford Clink 82351 (206)**, born July 1, 1932, bred by J. Triffitt, Fulford, York; *s.* Fulford Deliverance 3rd 74861, *d.* Wharfedale Wink 187720 *by* Wharfedale Clinker 51673.
2689 III.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Wratting Sultan's Lad 86993 (759)**, born July 24, 1933; *s.* Laybrook Sultan's Lad 75045, *d.* Wratting Choice 6th 218910 *by* Histon Apollo 66889.

2687 R.N.—W. HALLAS, Bank House Farm, Helsby, Warrington, for **Woodhatch Goliath.**
H.C.—2685, 2688.

Class 370.—*Middle White Boars, born in* 1934, *before July* 1.

2692 I., **R.N. for Champion**[2] **& R.N. for Special.**[4]—W. W. BUCKLE, Old Lane Farm, Colton, Tadcaster, for **Colton De Reszke 86699 (252)**, born Jan. 12; *s.* Wiggenhall Clinker Boy 82675, *d.* Colton Dora 217590 *by* Wiggenhall Expectation 2nd 75375.
2697 II.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Wratting Sultan's Lad 6th (898)**, born March 19; *s.* Laybrook Sultan's Lad 75045, *d.* Wratting Choice 6th 218910 *by* Histon Apollo 66889.
2693 III.—CHIVERS & SONS, Ltd., Histon, Cambridge, for **Histon Marmion 32nd (716)**, born Jan. 26; *s.* Histon Marmion 6th 79067, *d.* Histon Choice 157th 218080 *by* Milpond Bertie 67783.

2694 R.N.—T. H. GLADSTONE, Eastcote Grange, Henley-in-Arden, for **Barston Bold Archer.**
H.C.—2690, 2695.

Class 371.—*Middle White Boars, born in* 1934, *on or after July* 1.[5]

2703 I.—R. A. VESTEY, Valence, Westerham, Kent, for **Burford Voltaire (520)**, born July 4, bred by E. M. Jowitt, Broad Road Farm, Bridport; *s.* Burford Ajax 75779, *d.* Burford Vamp 217560 *by* Pendley Reveller 74417.
2704 II.—WATFORD CORPORATION, Holywell Farm, Watford, for **Watford Marmion (14)**, born July 19; *s.* Histon Marmion 19th, *d.* Pendley Dorothy 16th 218582 *by* Amport Illuminator 11th 74667.
2702 III.—JOSEPH TRIFFITT, Fulford, York, for **Colton Clink (300)**, born July 11; *s.* Wiggenhall Clinker Boy 82675, *d.* Colton Belle 217586 *by* Salts Deliverance 9th 55147.

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[1] Special Prize given by the Northumberland and Durham County Agricultural Societies to Members of those Societies residing or occupying land in the counties of Northumberland or Durham, for most points awarded in a combination of entries in the Large White Pig Classes.
[2] Champion Gold Medal, or £5 cash, given by the National Pig Breeders' Association for the best Middle White Boar.
[3] Silver Challenge Cup given by the National Pig Breeders' Association for the best Middle White Pig.
[4] Special Prize of Two Guineas given by the National Pig Breeders' Association for the best Middle White Pig whose dam has qualified for registration in this Association's Advance Register of Fecundity.
[5] Prizes given by the National Pig Breeders' Association.

2701 R.N.—LESLIE K. OSMOND, Barnoldby-le-Beck, Grimsby, for **Beelsby Jamieson 14th.** H.C.—2699.

2704, 2726, 2738, 2743 Special I.[1]—WATFORD CORPORATION, for **Watford Marmion, Watford Gracious Lady, Watford Gracious Lady 6th and Watford Dorothy 2nd.**

2684, 2693, 2718, 2739 Special II.[1]—CHIVERS & SONS, LTD., for **Histon Marmion 6th, Histon Marmion 32nd, Histon Woodlands 32nd and Histon Woodlands 37th.**

2686, 2694, 2719, 2732 R.N. for Specials.[1]—T. H. GLADSTONE, for **Barston Prince 4th, Barston Bold Archer, Barston Princess 5th and Barston Dorothy 7th.**

Class 372.—*Middle White Boars, born in* 1935.

2711 I.—CAPT. D. P. LITHGOW, Manor House, South Newington, Banbury, for **Newton Triton** (1283), born Jan. 6; *s.* Newton Neptune 82531, *d.* Newton Princess 2nd 210490 *by* Pendley Deliverance 7th 74389.

2714 II.—LESLIE K. OSMOND, Barnoldby-le-Beck, Grimsby, for **Beelsby Illuminator 11th** (1261), born Jan. 16; *s.* Beelsby Illuminator 4th 82265, *d.* Histon Hagar 42nd 209934 *by* Shawlands Bold Boy 67965.

2717 III.—WATFORD CORPORATION, Holywell Farm, Watford, for **Newton Triton 3rd** (1284), born Jan. 6, bred by Capt. D. P. Lithgow, Newington Manor, Banbury; *s.* Newton Neptune 82531, *d.* Newton Princess 2nd 210490 *by* Pendley Deliverance 7th 74389.

2706 IV.—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Marmion 34th** (918), born Jan. 1; *s.* Histon Marmion 6th 79067, *d.* Histon Woodlands 32nd 218162 *by* Histon Revel 20th 74991.

2713 R.N.—LESLIE K. OSMOND, for **Beelsby Deliverance 4th.**
H.C.—2707, 2715.

Class 373.—*Middle White Breeding Sows, born in or before* 1933.

2726 I., R.N. for Champion[2] & Champion.[3]—WATFORD CORPORATION, Holywell Farm, Watford, for **Watford Gracious Lady** 228370, born Feb. 6, 1933, farrowed Feb. 24; *s.* Wiggenhall Clinker 16th 79307, *d.* Shawlands Gracious Lady 11th 202520 *by* Shawlands Bold Boy 67965.

2722 II. & R.N. for Champion.[3]—CAPT. D. P. LITHGOW, Manor House, South Newington, Banbury, for **Newton Nightingale 3rd** 218458 (48), born Jan. 24, 1932, farrowed June 16; *s.* Pendley Deliverance 7th 74389, *d.* Steepness Nightingale 2nd 200572 *by* Compton Khan 66711.

2724 III.—LESLIE K. OSMOND, Barnoldby-le-Beck, Grimsby, for **Pendley Princess Royal** 218602 (594), born Aug. 20, 1932, farrowed March 31, bred by Sir Gomer Berry, Bart., Pendley Manor, Tring; *s.* Wharfedale Wimple, 68053, *d.* Pendley Princess 14th 200208 *by* Salts Deliverance 8th 55145.

2719 R.N.—T. H. GLADSTONE, Eastcote Grange, Hampton-in-Arden, for **Barston Princess 5th.**

Class 374.—*Middle White Sows, born in* 1934, *before July* 1.

2730 I.—W. W. BUCKLE, Ole Lane Farm, Colton, Tadcaster, for **Colton Joyful 2nd** 227652 (264), born Jan. 15; *s.* Wiggenhall Clinker Boy 82675, *d.* Colton Belle 217586 *by* Salts Deliverance 9th 55147.

2732 II.—T. H. GLADSTONE, Eastcote Grange, Hampton-in-Arden, for **Barston Dorothy 7th** (885), born Jan. 7; *s.* Barston Prince 4th 82285, *d.* Shawlands Miss Dorothy 68th 210698 *by* Fordon Dignity 2nd 67577.

2727 III.—LT.-COL. R. W. BARCLAY, Bury Hill, Dorking, for **Histon Woodlands 34th** 227986 (675), born Jan. 1, bred by Chivers & Sons, Ltd., Histon, Cambridge; *s.* Histon Marmion 6th 79067, *d.* Histon Woodlands 32nd 218162 *by* Histon Revel 20th 74991.

2737 IV.—R. A. VESTEY, Valence, Westerham, Kent, for **Dunsdale Lady Dorothy 3rd** 227782 (186), born Jan. 10; *s.* Shawlands Bold Knight 10th 82681, *d.* Shawlands Miss Dorothy 89th 228322 *by* Fordon Dignity 2nd 67577.

2738 R.N.—WATFORD CORPORATION, Holywell Farm, Watford, for **Watford Gracious Lady 6th.**
H.C.—2729, 2733.

Class 375.—*Middle White Sows, born in* 1934, *on or after July* 1.

2741 I.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Wratting Garland 3rd** (996), born July 5; *s.* Laybrook Sultan 2nd 74275, *d.* Mistley Garland 190th 210352 *by* Mistley Knight 74331.

2743 II.—WATFORD CORPORATION, Holywell Farm, Watford, for **Watford Dorothy 2nd** (11), born July 19; *s.* Histon Marmion 19th, *d.* Pendley Dorothy 16th 218582 *by* Amport Illuminator 11th 74667.

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[1] Special Prizes of a Gold Medal or £5 cash (First Prize) and a Silver Gilt Medal or £2 10s. cash (Second Prize) given by the National Pig Breeders' Association for the best groups of four Middle White Pigs, bred by Exhibitor. One Boar (at least) had to be included in each group, and not more than one entry selected from any one Class.

[2] Silver Challenge Cup given by the National Pig Breeders' Association for the best Middle White Pig.

[3] Champion Gold Medal, or £5 cash, given by the National Pig Breeders' Association for the best Middle White Sow.

2739 III.—CHIVERS & SONS, LTD., Histon, Cambridge, for **Histon Woodlands 37th** (807), born July 12; *s.* Histon Deliverance 13th 82417, *d.* Histon Woodlands 32nd 218162 *by* Histon Revel 20th 74991.

2742 R.N.—R. A. VESTEY, Valence, Westerham, Kent, for **Burford Vermouth.**
H.C.—2740.

Class 376.—*Middle White Sows, born in* 1935.

2752 I.—LESLIE K. OSMOND, Barnoldby-le-Beck, Grimsby, for **Beelsby Fuchsia 6th** (1267), born Jan. 17; *s.* Beelsby Deliverance 3rd 86657, *d.* Amport Fuchsia 20th 200886 *by* Amport Illuminator 4th 74661.
2750 II.—CAPT. D. P. LITHGOW, Manor House, South Newington, Banbury, for **Newton Princess 22nd** (1286), born Jan. 6; *s.* Newton Neptune 82531, *d.* Newton Princess 2nd 210490 *by* Pendley Deliverance 7th 74389.
2751 III.—CAPT. D. P. LITHGOW, for **Newton Princess 23rd** (1291), born Jan. 6; *s.* Newton Neptune 82531, *d.* Newton Princess 2nd 210490 *by* Pendley Deliverance 7th 74389.
2749 IV.—JOSEPH S. HICKS, Fordon, Wold Newton, Driffield, for **Fordon Myrtle** (303), born Jan. 21; *s.* Fordon Veteran 2nd 86785, *d.* Fordon May 217806 *by* Wharfedale Intention 75353.

2754 R.N.—WATFORD CORPORATION, Holywell Farm, Watford, for **Newton Princess 24th.**
H.C.—2746.

Tamworths.

Class 377.—*Tamworth Boars, born in or before* 1933.

2757 I., Champion[1] & Champion.[2]—COL. C. J. H. WHEATLEY, Berkswell Hall, Coventry, for **Berkswell Up-to-Date 11th 92001** (837), born Feb 4, 1933; *s.* Wall Up-to-Date 73887, *d.* Peartown Golden Slumbers 4th 183258 *by* Leighton William 28453.
2756 II.—MRS. CARLETON COWPER, Eamont, Penrith, for **Coldfield Miller 86615** (105), born May 23, 1933, bred by J. A. Frost, Newhall Farm, Sutton Coldfield; *s.* Berkswell Up-to-Date 78813, *d.* Coldfield Myra 217344 *by* Coldfield Mike 70575.
2755 III.—MRS. CARLETON COWPER, for **Berkswell Luck 2nd 86593** (811), born Oct. 20, 1932, bred by Col. C. J. H. Wheatley, Berkswell Hall, Coventry; *s.* Milton Luck 3rd 78861, *d.* Berkswell Frances 192408 *by* Berkswell Red Glove 64151.

Class 378.—*Tamworth Boars, born in* 1934.[3]

2760 I. & R.N. for Champion.[1]—MRS. CARLETON COWPER, Eamont, Penrith, for **Eamont Bounty 92017** (3), born Jan. 1; *s.* Berkswell Luck 2nd 86593, *d.* Berkswell Verna 2nd 227360 *by* Wall Up-to-Date 73887.
2762 II.—T. R. WILSON, Victoria House, Rufforth, York, for **Coldfield Merryman 92013** (124), born Jan. 23, bred by J. A. Frost, Newhall Farm, Sutton Coldfield; *s.* Coldfield Maurice 82213, *d.* Coldfield Myra 217344 *by* Coldfield Mike 70575.
2758 III.—E. CLIFTON-BROWN, Burnham Grove, Burnham, Bucks., for **Worplesdon Peter** (18), born Aug. 15, bred by James R. Fox, Dromore, Horsell Rise, Woking; *s.* Berkswell Peter 3rd 81287, *d.* Berkswell Slumbers 6th 217296 *by* Wall Up-to-Date 73887.

2761 R.N.—COL. C. J. H. WHEATLEY, Berkswell Hall, Coventry, for **Berkswell Budget.**

Class 379.—*Tamworth Boars, born in* 1935.

2767 I.—T. R. WILSON, Victoria House, Rufforth, York, for **Rufforth Gold Getter 2nd** (253), born Jan. 8; *s.* Wall Gold Getter 82247, *d.* Rufforth Yorkshire Lass 2nd 241098 *by* Berkswell Peter 3rd 82187.
2764 II.—MRS. CARLETON COWPER, Eamont, Penrith, for **Eamont Frontispiece** (23), born Jan. 7; *s.* Berkswell Luck 2nd 86593, *d.* Berkswell Verna 2nd 227360 *by* Wall Up-to-Date 73887.
2763 III.—MRS. CARLETON COWPER, for **Eamont Foremost** (22), born Jan. 7; s. Berkswell Luck 2nd 86593, *d.* Berkswell Verna 2nd 227360 *by* Wall Up-to-Date 73887.

2766 R.N.—COL. C. J. H. WHEATLEY, Berkswell Hall, Coventry, for **Berkswell Modern Lad 2nd.**

Class 380.—*Tamworth Breeding Sows, born in or before* 1933.

2769 I., R.N. for Champion,[2] Champion[4] & Champion.[5]—MRS. CARLETON COWPER, Eamont, Penrith, for **Berkswell Rose 9th 227348** (834), born Jan. 30, 1933, farrowed Jan. 2, bred by Col. C. J. H. Wheatley, Berkswell Hall, Coventry; *s.* Berkswell Peter 3rd 82187, *d.* Berkswell Rose 4th 217282 *by* Dollar Bobbie 73777.

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[1] Champion Silver Gilt Medal, or £2 10*s.* in cash, given by the National Pig Breeders' Association for the best Tamworth Boar.
[2] Silver Challenge Cup given through the National Pig Breeders' Association for the best Tamworth Pig.
[3] Prizes given by the National Pig Breeders' Association.
[4] Champion Silver Gilt Medal, or £2 10*s.* in cash, given by the National Pig Breeders' Association for the best Tamworth Sow.
[5] Special Prize of Two Guineas given by the National Pig Breeders' Association for the best Tamworth Pig whose dam has qualified for registration in this Association's Advance Register of Fecundity.

2771 II.—T. R. WILSON, Victoria House, Rufforth, York, for **Rufforth Brilliant Girl 5th** 227424 (145), born Jan. 2, 1933, farrowed Feb. 20; *s.* Whittingham Dude 3rd 78871, *d.* Rufforth Brilliant Girl 2nd 209290 *by* Rufforth Bonny Boy 73865.

2770 III.—MRS. CARLETON COWPER, for **Berkswell Slumbers 3rd** 217290 (488), born May 12, 1931, farrowed Feb. 23, bred by Col. C. J. H. Wheatley, Berkswell Hall, Coventry; *s.* Dollar Bobbie 73777, *d.* Peartown Golden Slumbers 3rd 183256 *by* Leighton William 28453.

Class 381.—*Tamworth Sows, born in* 1934.

2774 I., R.N. for Champion[1] & R.N. for Champion.[2]—COL. C. J. H. WHEATLEY, Berkswell Hall, Coventry, for **Berkswell Rose 14th** (918), born March 1; *s.* Berkswell Up-to-Date 5th 82191, *d.* Berkswell Rose 4th 217282 *by* Dollar Bobbie 73777.

2776 II.—T. R. WILSON, Victoria House, Rufforth, York, for **Rufforth Brilliant Lass** 241092 (210), born Jan. 22; *s.* Wall Gold Getter 82247, *d.* Rufforth Brilliant Girl 2nd 209290 *by* Rufforth Bonny Boy 73865.

2773 III.—MRS. CARLETON COWPER, Eamont, Penrith, for **Eamont Dawn** 241034 (15), born July 3; *s.* Berkswell Luck 2nd 86593, *d.* Berkswell Verna 2nd 227360 *by* Wall Up-to-Date 73887.

2775 R.N.—COL. C. J. H. WHEATLEY, for **Berkswell Slumbers 13th.**
H.C.—2772.

Class 382.—*Tamworth Sows, born in* 1935.

2780 I.—T. R. WILSON, Victoria House, Rufforth, York, for **Rufforth Lass 3rd** (255), born Jan. 8; *s.* Wall Gold Getter 82247, *d.* Rufforth Lass 2nd 241098 *by* Berkswell Peter 3rd 82187.

2777 II.—E. CLIFTON-BROWN, Burnham Grove, Burnham, Bucks., for **Burnham Constance** (427), born Jan. 4; *s.* Berkswell Peter 3rd 82187, *d.* Berkswell Constance 16th 217262 *by* Dollar Bobbie 73777.

2779 III.—MRS. CARLETON COWPER, Eamont, Penrith, for **Eamont Felicity** (26), born Jan. 7; *s.* Berkswell Luck 2nd 86593, *d.* Berkswell Verna 2nd 227360 *by* Wall Up-to-Date 73887.

2778 R.N.—MRS. CARLETON COWPER, for **Eamont Fairy.**

Berkshires.

Class 383.—*Berkshire Boars, born in or before* 1933.

2785 I., Champion[3] & Champion.[4]—FRANK TOWNEND, Highfield, Moor Allerton, Leeds, for **Dringhouses Resolute** 3933, born July 19, 1933, bred by Col. G. E. Wilkinson, D.S.O., Dringhouses Manor, York; *s.* Suddon Sharper 3755, *d.* Dringhouses Viola 13258 *by* Swinton John 2643.

2782 II.—E. CLIFTON-BROWN, Burnham Grove, Burnham, Bucks., for **Burnham Prim Lad** 3825, born March 7, 1932; *s.* Hillsborough Mr. Prim 6th 3231, *d.* Burnham Griqua 11538 *by* Burnham Nutcracker 2785.

2783 III.—LT.-COL. J. A. DUNNINGTON-JEFFERSON, D.S.O., Thicket Priory, York, for **Thicket Marksman** 3891, born July 16, 1932; *s.* Iwerne Marker 2909, *d.* Thicket Janet Lunn 13018 *by* Southworth Isaac 2611.
C.—2781, 2784.

Class 384.—*Berkshire Boars, born in* 1934, *before July* 1.

2786 I., R.N. for Champion[3] & Special.[5]—S. CECIL ARMITAGE, Lenton Fields, Nottingham, for **Burnham Prim Boy** 3919, born Jan. 15, bred by E. Clifton-Brown, Burnham, Bucks.; *s.* Burnham Prim Lad 3825, *d.* Manor Winifred 10962 *by* Kingstone British King 1692.

Class 385.—*Berkshire Boars, born in* 1934, *on or after July* 1.[6]

2787 I.—MAJOR CLIVE BEHRENS, Swinton Grange, Malton, for **Swinton Sweeper 4th**, born Aug. 3; *s.* Syerston President 6th 3393, *d.* Swinton Winsome Margaret 3rd 13528 *by* Woodhouse Amanullah 2691.

2788 II.—FRANK TOWNEND, Highfield, Moor Allerton, Leeds, for **Dringhouses President 2nd**, born July 28, bred by Col. G. E. Wilkinson, D.S.O., Dringhouses Manor, York.; *s.* Suddon Sharper 3755, *d.* Dringhouses Excelsa 13250 *by* Swinton John 2643.

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[1] Champion Silver Gilt Medal, or £2 10*s*. in cash, given by the National Pig Breeders' Association for the best Tamworth Sow.

[2] Special Prize of Two Guineas given by the National Pig Breeders' Association for the best Tamworth Pig whose dam has qualified for registration in this Association's Advance Register of Fecundity.

[3] Champion Silver Gilt Medal, or £2 10*s*. cash, given by the National Pig Breeders' Association for the best Berkshire Boar.

[4] The "Eaton" Silver Challenge Cup given through the National Pig Breeders' Association for the best Berkshire Pig.

[5] Special Prize of Two Guineas given by the National Pig Breeders' Association for the best Berkshire Pig whose dam has qualified for registration in this Association's Advance Register of Fecundity.

[6] Prizes given by the National Pig Breeders' Association.

Class 386.—*Berkshire Boars, born in* 1935.

2790 I.—E. Clifton-Brown, Burnham Grove, Burnham, Bucks., for **Burnham Griqua Gaylad**, born Jan. 3; *s.* Burnham Prim Lad 3825, *d.* Burnham Griqua Maid 14006 *by* Lenton Keystone 3551.

2792 II.—Frank Townend, Highfield, Moor Allerton, Leeds, for **Highfield Royal President 50th**, born Jan. 17; *s.* Highfield Royal President 43rd 3939, *d.* Dringhouses Princess Royal 4th *by* Suddon Sharper 3755.

2791 III.—Stephen D. Player, Whatton Manor, Whatton-in-the-Vale, Notts., for **Whipling Pygmalion 2nd**, born Jan. 3; *s.* Highfield Royal Pygmalion 28th 3941, *d.* Whipling Amelia 3rd 13954 *by* Lenton British Duke 2nd 3543.

2793 R.N.—Col. G. E. Wilkinson, C.B.E., D.S.O., Dringhouses Manor, York, for **Dringhouses Jubilee.**

C.—2789.

Class 387.—*Berkshire Breeding Sows, born in or before* 1933.

2796 I., R.N. for Champion[1] & Champion.[2]—E. Clifton-Brown, Burnham Grove, Burnham, Bucks., for **Burnham Griqua Maid** 14006, born June 23, 1933, farrowed Jan. 3; *s.* Lenton Keystone 3551, *d.* Burnham Griqua Lass 3rd 13146 *by* Hammonds Petronious 2055.

2794 II. & R.N. for Champion.[2]—S. Cecil Armitage, Lenton Fields, Nottingham, for **Bridge Primrose** 11506, born July 1, 1930, farrowed Feb. 16, bred by J. Fricker, Junr., Bridge Farm, Hardington, Yeovil; *s.* Bridge Keystone 1961, *d.* Bridge Patience 7432 *by* Iwerne Exchequer 784.

2795 III.—Major Clive Behrens, Swinton Grange, Malton, for **Swinton Precious Margaret 6th** 12922, born Jan. 4, 1931, farrowed Jan. 6; *s.* Woodhouse Amanullah 2nd 2691, *d.* Swinton Bold Margaret 7th 11172 *by* Highfield Roy President 6th 1638.

2798 R.N.—E. Clifton-Brown, for **Fullerton Sally.**

Class 388.—*Berkshire Sows, born in* 1934, *before July* 1.

2811 I.—Col. G. E. Wilkinson, C.B.E., D.S.O., Dringhouses Manor, York, for **Dringhouses Diana 2nd**, born Jan. 19; *s.* Suddon Sharper 3755, *d.* Dringhouses Diana 13248 *by* Swinton John 2643.

2809 II.—Frank Townend, Highfield, Moor Allerton, Leeds, for **Dringhouses Pansy** 14050, born Jan. 20, bred by Col. G. E. Wilkinson, D.S.O., Dringhouses Manor, York; *s.* Suddon Sharper 3755, *d.* Dringhouses Viola 13258 *by* Swinton John 2643.

2808 III.—Stephen D. Player, Whatton Manor, Whatton-in-the-Vale, Notts., for **Whipling Lady** 14158, born Jan. 11; *s.* Lenton British Duke 3543, *d.* Leadenham Lady 28th 12732 *by* Lenton Grand Duke 2nd 2949.

2810 R.N.—Frank Townend, for **Dringhouses Princess Royal 3rd.**

Class 389.—*Berkshire Sows, born in* 1934, *on or after July* 1.

2812 I.—Major Clive Behrens, Swinton Grange, Malton, for **Swinton Smiling Margaret 4th**, born Aug. 3; *s.* Syerston President 6th 3393, *d.* Swinton Winsome Margaret 3rd 13528 *by* Woodhouse Amanullah 2nd 2691.

2814 II.—E. Clifton-Brown, Burnham Grove, Burnham, Bucks., for **Burnham Milady**, born July 13; *s.* Burnham Prim Lad 3825, *d.* Burnham Maruja Lady 14010 *by* Lenton Keystone 3551.

2813 III.—E. Clifton-Brown, for **Burnham Griqua Gloriana**, born July 27; *s.* Burnham Prim Lad 3825, *d.* Burnham Griqua Lass 3rd 13146 *by* Hammonds Petronious 2055.

2820 IV.—Col. G. E. Wilkinson, C.B.E., D.S.O., Dringhouses Manor, York, for **Dringhouses Salvia 2nd**, born Aug. 13; *s.* Suddon Sharper 3755, *d.* Dringhouses Salvia 13760 *by* Swinton John 2643.

Class 390.—*Berkshire Sows, born in* 1935.

2822 I.—S. Cecil Armitage, Lenton Fields, Nottingham, for **Lenton Venus 3rd**, born Jan. 10; *s.* Lenton Keystone 2nd 3711, *d.* Lenton Venus 13846 *by* Lenton British Baron 2nd 2135.

2827 II.—Frank Townend, Highfield, Moor Allerton, Leeds, for **Highfield Princess Royal 80th**, born Jan. 17; *s.* Highfield Royal President 43rd 3939, *d.* Dringhouses Princess Royal 4th *by* Suddon Sharper 3755.

2828 III.—Col. G. E. Wilkinson, C.B.E., D.S.O., Dringhouses Manor, York, for **Dringhouses Excelsa 3rd**, born Jan. 9; *s.* Highfield Roy President 6th 1638, *d.* Dringhouses Excelsa 13250 *by* Swinton John 2643.

2826 R.N.—Stephen D. Player, Whatton Manor, Whatton-in-the-Vale, Notts., for **Whipling Lady 2nd.**

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[1] The "Eaton" Silver Challenge Cup given through the National Pig Breeders' Association for the best Berkshire Pig.

[2] Champion Silver Gilt Medal, or £2 10*s.* cash, given by the National Pig Breeders' Association for the best Berkshire Sow.

Wessex Saddlebacks.

Class 391.—*Wessex Saddleback Boars, born in or before* 1933.

2830 I. & R.N. for Champion.[1]—FRED W. GENTLE, 33, High Street, Brandon, Suffolk, for **Brandon David 2nd** 3737, born Jan. 7, 1933; *s.* Brandon David 3495, *d.* Brandon Poppy 11th 16074 *by* Brandon Dunstan 3161.

2829 II.—H. L. BROOKSBANK, Sandrock, Tickhill, Yorks., for **Holmsleigh Oak** 3509, born Feb. 20, 1931, bred by Henry Loosmore, Holmsleigh, Cotleigh, Honiton; *s.* Yarty Monarch 4th 3407, *d.* Holmsleigh Susan 14530 *by* Culm Valley Victor 2824.

2834 III.—DOUGLAS VICKERS, Preston, Hitchin, for **Clough Earl** 3744, born Feb. 22, 1933; *s.* Ravensdale Earl 3620, *d.* Ravensdale Lovely 4th 16092 *by* Sandrock Bandmaster 3458.

2832 R.N.—J. W. ROBERTS, Hill Farm, Shefford, Beds., for **Holbury Rusk.**

Class 392.—*Wessex Saddleback Boars, born in* 1934.[2]

2837 I. Champion[1], Champion[3] & Special[4].—DOUGLAS VICKERS, Preston, Hitchin, for **Preston Officer** 3880, born Jan. 2; *s.* Preston Val 3673, *d.* Preston Oonagh 15443 *by* Paul of Preston 3222.

2835 II.—FRED W. GENTLE, 33, High Street, Brandon, Suffolk, for **Brandon Oak 4th** 3859, born Feb. 25; *s.* Holmsleigh Oak 4th 3541, *d.* Brandon Orphan 2nd 17146 *by* Brandon Prior 3496.

2838 III.—WYNDHAM T. VINT, Thorn Cottage, Wroot, Doncaster, for **Sandrock Duke** 3790, born Jan. 25, bred by H. L. Brooksbank, Sandrock, Tickhill, Yorks.; *s.* Pamber Dandy 2nd 3675, *d.* Sandrock Duchess 8th 17027 *by* Yarty Regent 3580.

2836 R.N.—J. W. ROBERTS, Hill Farm, Shefford, Beds., for **Shefford Carlos 3rd.**

Class 393.—*Wessex Saddleback Boars, born in* 1935.

2845 I.—DOUGLAS VICKERS, Preston, Hitchin, for **Preston Simon** 3901, born Jan. 8; *s.* Boreham Barrington 2nd 3803, *d.* Preston Shamrock 2nd 17131 *by* Preston Dandy 2935.

2839 II.—H. L. BROOKSBANK, Sandrock, Tickhill, Yorks., for **Sandrock Frivolity 4th** 3898, born Jan. 4; *s.* Preston Silver King 3rd 3787, *d.* Sandrock Frivolous 11th 17505 *by* Yarty Regent 3580.

2844 III.—DOUGLAS VICKERS, for **Preston Oberon** 3900, born Jan. 7; *s.* Preston Val 3673, *d.* Preston Oonagh 15443 *by* Paul of Preston 3222.

2841 R.N.—HENRY KIRKE, Stainton-le-Vale, Tealby, Lincoln, for **Ravendale Prince.**

Class 394.—*Wessex Saddleback Breeding Sows, born in or before* 1933.

2847 I.—FRED W. GENTLE, 33, High Street, Brandon, Suffolk, for **Chellaston Sally 13th** 16349, born Jan. 5, 1932, farrowed Jan. 12, bred by F. W. Gilbert, Chellaston, Derby; *s.* Chellaston Royal's Son 3450, *d.* Chellaston Sally 10th 15826 *by* Besford Hero 1st 3168.

2851 II.—J. W. ROBERTS, Hill Farm, Shefford, Beds., for **Preston Orient 2nd** 17081, born Jan. 17, 1933, farrowed Jan. 14, bred by Douglas Vickers, Preston, Hitchin; *s.* Preston Dandy 2935, *d.* Preston Orient 15597 *by* Chellaston Gone Away 3159.

2855 III.—DOUGLAS VICKERS, Preston, Hitchin, for **Slythehurst Romantic** 16154, born July 18, 1931, farrowed March 9, bred by Dr. W. H. Forshaw, Slythehurst, Ewhurst; *s.* Slythehurst Cashier 3416, *d.* Slythehurst Romance 15661 *by* Godalming Rover 2nd 3321.

2849 R.N.—F. W. GILBERT, The Manor, Chellaston, Derby, for **Chellaston Laura 3rd.**

Class 395.—*Wessex Saddleback Sows, born in* 1934.

2858 I., R.N. for Champion[3] & Champion.[5]—FRED W. GENTLE, 33, High Street, Brandon, Suffolk, for **Brandon Poppy 15th** 17267, born Jan. 28; *s.* Godalming Cæsar 2nd 3684, *d.* Brandon Poppy 9th 15939 *by* Brandon Dunstan 3161.

2863 II., R.N. for Special[4] & R.N. for Champion.[5]—DOUGLAS VICKERS, Preston, Hitchin, for **Preston Value 2nd** 17539, born March 1; *s.* Holmsleigh Oak 3509, *d.* Preston Value 16333 *by* Yarty Monarch 3rd 3282.

2860 III.—J. W. ROBERTS, Hill Farm, Shefford, Beds., for **Preston Venus 4th** 17159, born Jan. 10, bred by Douglas Vickers, Preston, Hitchin; *s.* Holmsleigh Oak 3509, *d.* Preston Venus 2nd 16323 *by* Yarty Monarch 3rd 3282.

2859 R.N.—FRED W. GENTLE, for **Brandon Sunshine.**

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[1] Champion Silver Gilt Medal, or £2 10*s.* cash, given by the National Pig Breeders Association for the best Wessex Saddleback Boar.

[2] Prizes given by the National Pig Breeders' Association.

[3] Silver Challenge Cup, given by the National Pig Breeders' Association for the best Wessex Saddleback Pig.

[4] Special Prize of Two Guineas given by the National Pig Breeders' Association for the best Wessex Saddleback Pig whose dam has qualified for registration in this Association's Advance Register of Fecundity.

[5] Champion Silver Gilt Medal, or £2 10*s.* cash, given by the National Pig Breeders' Association for the best Wessex Saddleback Sow.

Class 396.—*Wessex Saddleback Sows, born in* 1935.

2867 I.—Fred W. Gentle, 33, High Street, Brandon, Suffolk, for **Brandon Poppy 20th** 17653, born Jan. 1; *s.* Godalming Monarch 3785, *d.* Brandon Poppy 9th 15939 *by* Brandon Dunstan 3161.
2874 II.—Douglas Vickers, Preston, Hitchin, for **Preston Shawbelle 3rd** 17538, born Jan. 1; *s.* Garth Nero 3742, *d.* Preston Shawbelle 17095 *by* Preston Dandy 2935.
2873 III.—Douglas Vickers, for **Preston Arid 3rd** 17586, born Jan. 3; *s.* Clough Earl 3746, *d.* Boreham Avid 6th 17200 *by* Slythehurst Romancer 3547.
2864 IV.—Henry Kirke, Stainton-le-Vale, Tealby, Lincoln, for **Ravendale Sally 3rd** 17569, born Jan. 10; *s.* Sandrock Prince 3728, *d.* Chellaston Sally 12th 15852 *by* Besford Hero 1st 3168.

2869 R.N.—H. L. Brooksbank, Sandrock, Tickhill, Yorks., for **Sandrock Frivolous 13th.**

Large Blacks.

Class 397.—*Large Black Boars, born in or before* 1933.

2877 I. & Champion[1].—Frank Sainsbury, Blunts Hall, Little Wratting, Haverhill, for **Kedington Royal** L. 231, born Jan. 5, 1933; *s.* Kedington None Such G. 97, *d.* Kedington Constance 23rd G. 2184 *by* Kedington Stump B. 97.
2876 II.—D. W. P. Gough, Pakenham Manor, Bury St. Edmunds, for **Tartar Talisman** L. 51, born Jan. 3, 1933, bred by G. A. Goodchild, Great Yeldham, Essex; *s.* Kedington None Such 3rd G. 293, *d.* Tartar Mary 4th G. 1414 *by* Kedington Broker E. 469.
2878 III.—Welbeck Estates Co., Ltd., Hunciecroft, Welbeck, Worksop, for **Fowlmere Night Boy 2nd** K. 195, born July 19, 1932, bred by W. C. Jackson, Fowlmere, Cambs.; *s.* Bardolph Night Boy E. 417, *d.* Fowlmere Fancy 2nd F. 364 *by* Bassingbourn Royal 2nd B. 641.

Class 398.—*Large Black Boars, born in* 1934, *before July* 1.

2881 I. & R.N. for Champion.[1]—D. W. P. Gough, Pakenham Manor, Bury St. Edmunds, for **Pakenham Tyne 1st** M. 221, born Feb. 6; *s.* Pakenham Rotation H. 303, *d.* Pakenham Prudence 2nd E. 610 *by* Drayton Proconsul C. 985.
2880 II.—F. W. Gilbert, The Manor, Chellaston, Derby, for **Chellaston Elector** M. 215, born March 1; *s.* Chellaston Hector 2nd K. 139, *d.* Fowlmere Famous 29th H. 586 *by* Bardolph Night Boy E. 417.
2882 III.—W. W. Woolland, Baydon Manor, Ramsbury, Marlborough, for **Baydon King John 3rd** M. 191, born March 1; *s.* Baydon King 5th H. 239, *d.* Cornwood Empress 1st G. 1316 *by* Treveglos Chief 1st C. 109.
2883 R.N.—W. W. Woolland, for **Baydon King John 4th.**

Class 399.—*Large Black Boars, born in* 1934, *on or after July* 1.[2]

2885 I.—D. W. P. Gough, Pakenham Manor, Bury St. Edmunds, for **Pakenham Sundial 19th** M. 271, born July 1; *s.* Westpetherwin Leader 2nd E. 553, *d.* Pakenham Sunshine 2nd G. 1740 *by* Pakenham Rambler F. 433.
2884 II.—The Earl of Dartmouth, Patshull House, Wolverhampton, for **Patshull Leader 21st** M. 253, born Oct. 2; *s.* Patshull Leader 7th H. 7, *d.* Tinten Princess 34th K. 384 *by* Westpetherwin Leader 2nd E. 553.
2887 III.—W. W. Woolland, Baydon Manor, Ramsbury, Marlborough, for **Baydon Royal Prince** M. 195, born July 5; *s.* Baydon Prince 2nd L. 177, *d.* Baydon Nightingale 98th L. 504 *by* Baydon King 5th H. 239.
2886 R.N.—T. F. James, Warren Farm, Culham, Abingdon, for **Treluckey Expectation.**

Class 400.—*Large Black Boars, born in* 1935.

2892 I.—F. W. Gilbert, The Manor, Chellaston, Derby, for **Chellaston Wonder** N. 47, born Jan. 11; *s.* Chellaston Hector 2nd K. 139, *d.* Chellaston Pearl 5th G. 824 *by* Tinten Result E. 371.
2889 II.—W. D. Craven, Upper Hurst, Hartington, Buxton, for **Hartington Saako** N. 27, born Jan. 7; *s.* Broyle Laddie 1st H. 131, *d.* Orchard Beverley 60th L. 90 *by* Spelia Park Dan H. 437.
2890 III.—The Earl of Dartmouth, Patshull House, Wolverhampton, for **Patshull Leader 22nd** N. 23, born Jan. 5; *s.* Trewithen Leader H. 325, *d.* Tinten Princess 35th K. 386 *by* Westpetherwin Leader 2nd E. 553.
2893 R.N.—D. W. P. Gough, Pakenham Manor, Bury St. Edmunds, for **Pakenham Salvage.**
H.C.—2897. C.—2891, 2895.

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[1] Silver Challenge Cup, and Gold Medal to the Breeder, given by the Large Black Pig Society for the best Large Black Boar.
[2] Prizes given by the Large Black Pig Society

Class 401.—*Large Black Breeding Sows, born in or before* 1933.

2900 I. & Champion.[1]—D. W. P. GOUGH, Pakenham Manor, Bury St. Edmunds, for **Pakenham Rosemary 3rd** G. 1380, born July 3, 1930, farrowed Feb. 1; *s.* Valley Candidate D. 787, *d.* Pakenham Rose 1st C. 2964 *by* Awton Sampson 21891.
2898 II.—THE EARL OF DARTMOUTH, Patshull House, Wolverhampton, for **Patshull Bangle 26th** H. 1280, born July 17, 1931, farrowed March 2; *s.* Tinten Leader C. 849, *d.* Patshull Bangle 20th E. 450 *by* Patshull Prince 1st B. 405.
2899 III.—F. W. GILBERT, The Manor, Chellaston, Derby, for **Chellaston Bangle 2nd** H. 810, born June 9, 1931, farrowed Jan. 9; *s.* Pakenham Bouncer 1st G. 49, *d.* Streetly Bangle 50th E. 1636 *by* Streetly Climber D. 597.
2901 R.N.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Kedington Caress 3rd.**
H.C.—2902.

Class 402.—*Large Black Sows, born in* 1934, *before July* 1.

2909 I. & R.N. for Champion.[1]—W. W. WOOLLAND, Baydon Manor, Ramsbury, Marlborough, for **Baydon Nightingale 99th** M. 80, born Jan. 11; *s.* Baydon King 5th H. 239, *d.* Baydon Nightingale 92nd H. 906 *by* Baydon Chief G. 311.
2908 II.—FRANK SAINSBURY, Blunts Hall, Little Wratting, Haverhill, for **Pakenham Sunshade 14th** M. 648, born Jan. 3, bred by D. W. P. Gough, Pakenham Manor, Bury St. Edmunds; *s.* Westpetherwin Leader 2nd E. 553, *d.* Pakenham Sunshine 2nd G. 1740 *by* Pakenham Rambler F. 433.
2905 III.—THE EARL OF DARTMOUTH, Patshull House, Wolverhampton, for **Patshull Susan 35th** M. 24, born Jan. 4; *s.* Trewithen Leader H. 325, *d.* Patshull Susan 29th K. 76 *by* Tinten Leader C. 849.
2904 R.N.—THE EARL OF DARTMOUTH, for **Patshull Susan 34th.**
H.C.—2907.

Class 403.—*Large Black Sows, born in* 1934, *on or after July* 1.

2914 I.—D. W. P. GOUGH, Pakenham Manor, Bury St. Edmunds, for **Pakenham Nancy 3rd** M. 822, born July 2; *s.* Westpetherwin Leader 2nd E. 553, *d.* Fowlmere Fancy 67th H. 598 *by* Bardolph Night Boy E. 417.
2913 II.—F. W. GILBERT, The Manor, Chellaston, Derby, for **Chellaston Lustrous Pearl 2nd** M. 584, born July 2; *s.* Pakenham Lucrative G. 283, *d.* Chellaston Pearl 5th G. 824 *by* Tinten Result E. 371.
2916 III.—W. W. WOOLLAND, Baydon Manor, Ramsbury, Marlborough, for **Baydon Nightingale 101st** M. 502, born July 7; *s.* Baydon King John 1st L. 157, *d.* Baydon Nightingale 92nd H. 906 *by* Baydon Chief G. 311.
2912 R.N.—THE EARL OF DARTMOUTH, Patshull House, Wolverhampton, for **Patshull Susan 39th.**
H.C.—2915. C.—2910.

Class 404.—*Large Black Sows, born in* 1935.

2922 I.—D. W. P. GOUGH, Pakenham Manor, Bury St. Edmunds, for **Pakenham Jubilant** N. 74, born Jan. 2; *s.* Pakenham Sundial 4th L. 193, *d.* Kedington Constance 29th L. 302 *by* Kedington None Such G. 97.
2919 II.—THE EARL OF DARTMOUTH, Patshull House, Wolverhampton, for **Patshull Bangle 40th** N. 30, born Jan. 5; *s.* Trewithen Leader H. 325, *d.* Patshull Bangle 28th L. 48 *by* Tinten Leader C. 849.
2921 III.—F. W. GILBERT, The Manor, Chellaston, Derby, for **Chellaston Wonder Pearl** N. 80, born Jan. 11; *s.* Chellaston Hector 2nd K. 139, *d.* Chellaston Pearl 5th G. 824 *by* Tinten Result E. 371.
2924 R.N.—W. W. WOOLLAND, Baydon Manor, Ramsbury, Marlborough. for **Baydon Jubilee Nightingale 102nd.**
H.C.—2920.
2881, 2900, 2914 Vase.[2]—D. W. P. GOUGH, for **Pakenham Tyne 1st, Pakenham Rosemary 3rd** and **Pakenham Nancy 3rd.**
2877, 2901, 2908 R.N. for Vase[2].—FRANK SAINSBURY, for **Kedington Royal, Kedington Caress 3rd** and **Pakenham Sunshade 14th.**

Gloucestershire Old Spots.

Class 405.—*Gloucestershire Old Spots Boars, born in or before* 1933.

2927 I. & R.N. for Champion.[3]—J. F. WRIGHT, Olton Farm, Solihull, for **Solihull Bob** 5915, born May 4, 1930; *s.* Solihull Buster 5858, *d.* Solihull Bonetta Z. 385 *by* Maiden Bradley Submarine 2nd 5720.

[1] Silver Challenge Cup, and Gold Medal to the Breeder, given by the Large Black Pig Society for the best Large Black Sow.
[2] The "Baydon" Gold Vase given through the Large Black Pig Society for the best Group consisting of one Boar from Classes 397, 398 or 399, one Breeding Sow from Class 401, and one Sow from Classes 401, 402 or 403.
[3] Silver Challenge Cup given through the Gloucester Old Spots Pig Society for the best Gloucestershire Old Spots Boar.

2925 II.—REGINALD H. HOLE, Clapcote, Grittleton, Chippenham, for **Chalfield Michael** 5980, born March 13, 1932, bred by Major R. F. Fuller, Great Chalfield, Melksham; *s.* Beara Michael 5867, *d.* Chalfield Blossom 7th Z. 588 *by* Maiden Bradley Judge 2nd 5825.

Class 406.—*Gloucestershire Old Spots Boars, born in* 1934.[1]

2931 I., **Champion**[2] **& Champion.**[3]—J. F. WRIGHT, Olton Farm, Solihull, for **Solihull Bob 7th** 6024, born April 9; *s.* Solihull Bob 5915, *d.* Solihull Josephine 9th Z. 525 *by* Solihull Buffalo 5845.
2929 II.—SHERRIFF & SONS, Lemsford, Welwyn Garden, Herts., for **Nashes Duke 28th** 6015, born Jan. 5; *s.* Nashes Bruce 6th 5971, *d.* Nashes Duchess 55th Z. 749 *by* Hempstead Jim 17th 5888.
2928 III.—S. C. FLOOK, Tynings Farm, Codrington. Chipping Sodbury, for **Tyning Bob** 6018, born Feb. 21; *s.* Winterbourne Samuel 6003, *d.* Tyning Beam Z. 780 *by* Knowle Ben 5908.
2930 R.N.—SHERRIFF & SONS, for **Nashes Duke 31st.**

Class 407.—*Gloucestershire Old Spots Boars, born in* 1935.

2933 I.—SHERRIFF & SONS, Lemsford, Welwyn Garden, Herts., for **Nashes Duke 34th** 6029, born Jan. 6; *s.* Nashes Duke 25th 5995, *d.* Nashes Duchess 55th Z. 749 *by* Hempstead Jim 17th 5888.
2935 II.—J. F. WRIGHT Olton Farm, Solihull, for **Solihull Bob 9th** 6027, born Feb. 22; *s.* Solihull Bob 5915, *d.* Solihull Josephine 12th Z. 605 *by* Holmwood Lillywhite 5th 5869.
2934 III.—J. F. WRIGHT, for **Solihull Bob 8th** 6026, born Feb. 22; *s.* Solihull Bob 5915, *d.* Solihull Josephine 12th Z. 605 *by* Holmwood Lillywhite 5th 5869.
2932 R.N.—SHERRIFF & SONS, for **Nashes Duke 33rd.**

Class 408.—*Gloucestershire Old Spots Breeding Sows, born in or before* 1933.

2937 I., **R.N. for Champion**[3] **& Champion.**[4]—SHERRIFF & SONS, Lemsford, Welwyn Garden, Herts., for **Nashes Duchess 55th** Z. 749, born Sept. 6, 1932, farrowed Jan. 6; *s.* Hempstead Jim 17th 5888, *d.* Nashes Duchess 49th Z. 631 *by* Hempstead Spot 5619.
2939 II.—J. F. WRIGHT, Olton Farm, Solihull, for **Solihull Susan 16th** Z. 763, born Jan. 22, 1933, farrowed March 3; *s.* Solihull Bob 5915, *d.* Solihull Susan 12th Z. 603 *by* Holmwood Lillywhite 5th 5869.
2936 III.—REGINALD H. HOLE, Clapcote, Grittleton, Chippenham, for **Clapcote Lady** Z. 808, born Aug. 15, 1933, farrowed Jan. 4; *s.* Ethell's Earl 3rd 5928, *d.* Clapcote Lout Z. 337 *by* Kitesnest Juror 5584.
2938 R.N.—SHERRIFF & SONS, for **Nashes Duchess 57th.**

Class 409.—*Gloucestershire Old Spots Sows, born in* 1934.

2945 I. **& R.N. for Champion.**[4]—J. F. WRIGHT, Olton Farm, Solihull, for **Solihull Primrose 14th** Z. 853, born April 9; *s.* Solihull Bob 5915, *d.* Solihull Prim Z. 528 *by* Knowle Bonzo 5769.
2942 II.—SHERRIFF & SONS, Lemsford, Welwyn Garden, Herts., for **Nashes Duchess 56th** Z. 810, born Jan. 5; *s.* Nashes Bruce 6th 5971, *d.* Nashes Duchess 55th Z. 749 *by* Hempstead Jim 17th 5888.
2944 III.—J. F. WRIGHT, for **Solihull Bonetta 11th** Z. 823, born Feb. 21; *s.* Nashes Duke 21st 5976, *d.* Solihull Bonetta Z. 385 *by* Maiden Bradley Submarine 2nd 5720.
2940 R.N.—S. C. FLOOK, Tynings Farm, Codrington, Chipping Sodbury, for **Tyning Beam 2nd.**
H.C.—2943. C.—2941.

Class 410.—*Gloucestershire Old Spots Sows, born in* 1935.

2950 I.—J. F. WRIGHT, Olton Farm, Solihull, for **Solihull Gertie 15th** Z. 866, born Jan. 10; *s.* Solihull Bob 5915, *d.* Solihull Gertie 12th Z. 527 *by* Solihull Buffalo 5845.
2946 II.—S. C. FLOOK, Tynings Farm, Codrington, Chipping Sodbury, for **Tyning Cream 15th** Z. 865, born Jan. 18; *s.* Winterbourne Samuel 6003, *d.* Tyning Cream 7th Z. 644 *by* Tyning Roger 5909.
2951 III.—J. F. WRIGHT, for **Solihull Primrose 15th** Z. 854, born Jan. 21; *s.* Solihull Bob 5915, *d.* Solihull Primrose Z. 571 *by* Solihull Buster 5858.
2948 R.N.—REGINALD H. HOLE, Clapcote, Grittleton, Chippenham, for **Clapcote Mint.**
H.C.—2947, 2949.

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[1] Prizes given by the Gloucestershire Old Spots Pig Society.
[2] Silver Challenge Cup given through the Gloucestershire Old Spots Pig Society for the best Gloucestershire Old Spots Boar.
[3] Perpetual Silver Challenge Cup given through the Gloucestershire Old Spots Pig Society for the best Gloucestershire Old Spots Pig.
[4] Perpetual Silver Challenge Cup given through the Gloucestershire Old Spots Pig Society for the best Gloucestershire Old Spots Sow.

Cumberlands.

Class 411.—*Cumberland Boars, born in or before* 1934.

2952 I. & Champion.[1]—ISAAC GARDHOUSE, Aikton House, Wigton, for **Bowston Nobleman** 9412 (J.O.R.N. 1), born Jan. 13, 1931, bred by J. S. Jordan, The Granary, Kendal; *s.* Anchor Admiral 10th 8890, *d.* Wampool Nora 7980 *by* Bowston Grenadier 6373.

2954 II.—MRS. JOHN C. STRAKER, Stagshaw House, Corbridge, for **Lonning Nat** 9464 (G.H.L.N. 1), born July 22, 1931, bred by H. L. Gardhouse, Lonning Farm, Wigton; *s.* Lonning Mast 9434, *d.* Lonning Mary 9170 *by* Angerton House Jester 8588.

2953 III.—RALPH MILLNER, Angerton, Kirkbride, Carlisle, for **Greenspot Pride** 9769 (G.R.K.P. 3), born April 4, 1933, bred by Richard Graham, Greenford, Kirkbride; *s.* Croft End Mark 9602, *d.* Greenspot Annie 9831 *by* Aikton Pride 8882.

2955 R.N.—DAVID WILKINSON, Grange Farm, Burnthouse Lane, Whickham, Newcastle-on-Tyne, for **Aikton House Victor.**

Class 412.—*Cumberland Boars, born in* 1935.

2957 I.—ISAAC GARDHOUSE, Aikton House, Wigton, for **Noble Silver King** (G.D.I.R. 3), born Jan. 3; *s.* Bowston Nobleman 9412, *d.* Aikton House Queen *by* Aikton House Squire 9772.

2962 II.—ROBERT WILSON, Dockrayrigg, Wigton, for **Dockray Rajah** (W.D.G.R. 2), born Jan. 31; *s.* Bowston Nobleman 9412, *d.* Greenspot Nellie 9531 *by* Aikton Pride 8882.

2961 III.—DAVID WILKINSON, Grange Farm, Burnthouse Lane, Whickham, Newcastle-on-Tyne, for **Aikton House Bruce** (G.D.I.R. 15), born Jan. 21, bred by Isaac Gardhouse, Aikton House, Wigton; *s.* Bowston Nobleman 9412, *d.* Aikton House Rowena 4th 9830 *by* Woodside Onward 9639.

2958 R.N.—RALPH MILLNER, Angerton, Kirkbride, Carlisle, for **Fairway Rollo.**

Class 413.—*Cumberland Sows, born in or before* 1934.

2965 I. & R.N. for Champion.[1]—RALPH MILLNER, Angerton, Kirkbride, Carlisle, for **Fairway Doris** 9727 (M.L.N.N. 86), born Sept. 2, 1931, farrowed Feb. 20; *s.* Greenspot Monarch 9015, *d.* Doris of Dolphenby 9205 *by* Wiggonrigg Jock 8590.

2963 II.—ISAAC GARDHOUSE, Aikton House, Wigton, for **Aikton House Queen** (G.D.I.Q. 18), born March 3, 1934, farrowed Jan. 3; *s.* Aikton House Squire 9772, *d.* Eamont Rowena 9687 *by* Lonning Nat 9464.

2966 III.—RALPH MILLNER, for **Fairway Norma** (M.L.N.Q. 4), born Feb. 18, 1934, farrowed Feb. 15; *s.* Prizet Michael 9613, *d.* Woodside Norma 9490 *by* Woodside Lion 8526.

2964 R.N.—ISAAC GARDHOUSE, for **Aikton House Rowena 4th.**

Class 414.—*Cumberland Sows, born in* 1935.

2971 I.—ISAAC GARDHOUSE, Aikton House, Wigton, for **Aikton House Phillis** (G.D.I.R. 27), born Feb. 4; *s.* Aikton House Victor, *d.* Croft House Phillis *by* Lonning Nat 9464.

2973 II.—RALPH MILLNER, Angerton, Krikbride, Carlisle, for **Fairway Opal 2nd** (M.L.N.R. 5), born Feb. 14; *s.* Greenspot Pride 9769, *d.* Fairway Opal *by* Greenspot Monarch 9015.

2972 III.—ISAAC GARDHOUSE, for **Aikton Silver Queen** (G.D.I.R. 5), born Jan. 3; *s.* Bowston Nobleman 9412, *d.* Aikton House Queen *by* Aikton House Squire 9772.

2976 R.N.—ROBERT WILSON, Dockrayrigg, Carlisle, for **Dockray Ruby.**

Essex.

Class 415.—*Essex Boars, born in or before* 1933.

2977 I.—F. J. BOSWORTH, Spains Hall, Willingale, Ongar, for **Roothing Sultan 2nd** 3981 (562), born Jan. 2, 1932, bred by W. Ritchie, Marks Hall, Margaret Roding; *s.* Benningtons Sultan 3795, *d.* Roothing Biddy 10th 20914 *by* Rickling Duke 4th 3581.

2978 II.—W. DENNIS & SONS, LTD., Kirton, Boston, Lincs., for **Bocking Duke** 4167 (653), born Aug. 7, 1933, bred by Major A. M. Tabor, Bovingdon Hall, Bocking; *s.* Chantry Casca 4049, *d.* Bocking Bangle 21104 *by* Thorley Mac 2nd 3775.

Class 416.—*Essex Boars, born in* 1934.

2982 I.—W. DENNIS & SONS, LTD., Kirton, Boston, Lincs., for **Kirton Grand Duke** 4241 (694), born Jan. 2; *s.* Cressing Grand Duke 16th 4141, *d.* Roothing Female 14th 21652 *by* Trueloves Atom 3847.

2981 II.—HAROLD H. BOWSER, Swineshead, Boston, Lincs., for **Cressing Grand Duke 23rd** 4199 (669), born Jan. 3, bred by A. J. Cousins, Cressing Lodge, Braintree; *s.* Trueloves Bachelor 4101, *d.* Cressing Grand Duchess 10th 21084 *by* Laver Peacock 3689.

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[1] Silver Challenge Cup given by the Cumberland Pig Breeders' Association for the best Cumberland Pig.

2983 III.—MAJOR A. M. TABOR, Bovingdon Hall, Bocking, Essex, for **Bocking Excelsior** 4323 (732), born March 28; *s.* Chantry Casca 4049, *d.* Bocking Duplicity 22022 *by* Thorley Mac 2nd 3775.

2980 R.N.—F. J. BOSWORTH, Spains Hall, Willingale, Ongar, for **Trueloves Eric.**

Class 417.—*Essex Boars, born in* 1935.

2993 I.—MRS. FRANK HILDER, Huskards, Ingatestone, for **Huskards Weeley Nevill 2nd** 4431 (786), born Jan. 26; *s.* Weeley Enterprize 16th 4139, *d.* Huskards Pipkin 19278 *by* Chantry Azurite 2433.

2992 II.—W. DENNIS & SONS, LTD., Kirton, Boston, Lincs., for **Kirton Janitor 4th** 4451 (801), born Jan. 2; *s.* Hanningfield Janitor 3965, *d.* Kirton Bess 21852 *by* Bocking Bouncer 3889.

2989 III.—HAROLD H. BOWSER, Swineshead, Boston, Lincs., for **Magdalen Nero 6th** 4471 (811), born Jan. 14; *s.* Cressing Grand Duke 23rd 4199, *d.* Magdalen Pride 20th 22110.

2994 IV.—MAJOR A. M. TABOR, Bovingdon Hall, Bocking, Essex, for **Bocking Fascist** 4467 (792), born Jan. 18; *s.* Chantry Casca 4049, *d.* Bocking Apple 20558 *by* Rickling Duke 5th 363.

2988 R.N.—F. J. BOSWORTH, Spains Hall, Willingale, Ongar, for **Laver Sultan 12th.**
H.C.—2987.

Class 418.—*Essex Breeding Sows, born in or before* 1933.

2999 I. & R.N. for Champion.[1]—F. J. BOSWORTH, Spains Hall, Willingale, Ongar, for **Laver Deer** 22494 (3210), born July 4, 1933, farrowed Jan. 12; *s.* Roothing Sultan 2nd 3981, *d.* Laver Cat 21272 *by* Barling Judge 3823.

3002 II.—W. DENNIS & SONS, LTD., Kirton, Boston, Lincs., for **Kirton Blanche** 21856 (2893), born Oct. 8, 1932, farrowed Jan. 6; *s.* Bocking Bouncer 3889.

3004 III.—TINNEY & HITCHCOCK, Church End, Rickling, Newport, Essex, for **Rickling Charlotte 27th** 20804 (2353), born March 20, 1930, farrowed Feb. 14; *s.* Peadowns Gay Lad 1st 3327, *d.* Rickling Charlotte 25th 19938 *by* Cressing Angus 4th 1985.

3000 R.N.—HAROLD H. BOWSER, Swineshead, Boston, Lincs., for **Magdalen Pride 14th.**
H.C.—2997.

Class 419.—*Essex Sows, born in* 1934.[2]

3008 I. & Champion.[1]—W. DENNIS & SONS, LTD., Kirton, Boston, Lincs., for **Cressing Grand Duchess 17th** 22716 (3312), born Jan. 7, bred by A. J. Cousins, Cressing Lodge, Braintree; *s.* Trueloves Bachelor 4101, *d.* Cressing Grand Duchess 4th 20452 *by* Cressing Jay 5th 3437.

3015 II.—TINNEY & HITCHCOCK, Church End, Rickling, Newport, Essex, for **Rickling Treasure 57th** 23618 (3765), born Jan. 1; *s.* Roothing Kaiser 5th 3681, *d.* Rickling Treasure 30th 20806 *by* Barling Cadet 2797.

3014 III.—MAJOR A. M. TABOR, Bovingdon Hall, Bocking, Essex, for **Bocking Esther** 22874 (3383), born Feb. 1; *s.* Chantry Casca 4049, *d.* Bocking Bangle 21104 *by* Thorley Mac 2nd 3775.

3011 IV.—MRS. FRANK HILDER, Huskards, Ingatestone, for **Huskards Loving Mollie** 22892 (3404), born July 16; *s.* Cressing Grand Duke 9th 3949, *d.* Trueloves Aim 2nd 21484 *by* Laver Drummer 3659.

3007 R.N.—HAROLD H. BOWSER, Swineshead, Boston, Lincs., for **Magdalen Pride 21st.**

Class 420.—*Essex Sows, born in* 1935.

3024 I.—MAJOR A. M. TABOR, Bovingdon Hall, Bocking, Essex, for **Bocking Fancy** 23578 (3699), born Jan. 3; *s.* Bocking Endeavour 4253, *d.* Bocking Benefit 21120 *by* Thorley Mac 2nd 3775.

3022 II.—W. DENNIS & SONS, LTD., Kirton, Boston, Lincs., for **Kirton Blanche 3rd** 23508 (3718), born Jan. 6; *s.* Benton Barling 4149, *d.* Kirton Blanche 21856 *by* Bocking Bouncer 3889.

3020 III.—HAROLD H. BOWSER, Swineshead, Boston, Lincs., for **Magdalen Pride 31st** 23616 (3764), born Jan. 14; *s.* Cressing Grand Duke 23rd 4199, *d.* Magdalen Pride 20th 22110.

3021 IV.—W. DENNIS & SONS, LTD., for **Kirton Bess 3rd** 23502 (3715), born Jan. 2; *s.* Hanningfield Janitor 3965, *d.* Kirton Bess 21852 *by* Bocking Bouncer 3889.

3019 R.N.—HAROLD H. BOWSER, for **Magdalen Pride 30th.**
H.C.—3017.

2982, 3002, 3008 Cup.[3]—W. DENNIS & SONS, LTD., for **Kirton Grand Duke, Kirton Blanche and Cressing Grand Duchess 17th.**

2977, 2999, 3006 R.N. for Cup.[3]—F. J. BOSWORTH, for **Roothing Sultan 2nd, Laver Deer and Laver Eager.**

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[1] Champion Silver Cup given by the Essex Pig Society for the best Essex Pig.
[2] Prizes given by the Essex Pig Society.
[3] The "Sedgemere" Silver Challenge Cup given through the Essex Pig Society for the best Group of Three Essex Pigs.

Long White Lop-eared.

Class 421.—*Long White Lop-Eared Boars, born in or before* 1934.

3029 I., Champion[1] & Champion.[2]—W. H. NEAL, Walreddon Farm, Tavistock, for **Treringey Captain 2nd 2494**, born Jan. 24, 1932, bred by A. H. Johns & Son, Treringey, Crantock; *s.* Devonshire Ladder 1880, *d.* Trethvas Duchess 4th 5941 *by* Priory Millman 10th 1586.

3027 II.—G. H. EUSTICE, Bezurrel, Gwinear, Hayle, for **Clifford Michael 2514**, born Aug. 13, 1932, bred by Dartington Hall, Ltd., Totnes, Devon; *s.* Prestow Rover 2190, *d.* Clifford Attraction 6769 *by* Ipplepen Hopeful 2106.

Class 422.—*Long White Lop-Eared Boars, born in* 1935.

3031 I. & R.N. for Champion.[1]—G. H. EUSTICE, Bezurrel, Gwinear, Hayle, for **Bezurrel Bacon Boy 45th 2828**, born Jan. 1; *s.* Bezurrel Bacon Boy 43rd 2718, *d.* Bezurrel Ruby 1st 7063 *by* Forest Pattern 1st 2204.

3033 II.—W. H. NEAL, Walreddon Farm, Tavistock, for **Yealmpston Gay Boy 14th 2848**, born Jan. 13; *s.* Treringey Captain 2nd 2494, *d.* Petherwin No. 24 of 1933 7599 *by* Trolvis Ben 11th 2328.

3030 III.—G. H. EUSTICE, for **Bezurrel Bacon Boy 44th 2826**, born Jan. 1; *s.* Bezurrel Bacon Boy 43rd 2718, *d.* Bezurrel Ruby 1st 7063 *by* Forest Pattern 1st 2204.

Class 423.—*Long White Lop-Eared Breeding Sows, born in or before* 1933.

3034 I. & R.N. for Champion[3] & Champion.[2]—G. H. EUSTICE, Bezurrel, Gwinear, Hayle, for **Bezurrel Ruby 2nd 7065**, born March 5, 1931, farrowed June 1; *s.* Forest Pattern 1st 2204, *d.* Bezurrel Mary 7th 5241 *by* Afton Gay Boy 1122.

3037 II.—W. H. NEAL, Walreddon Farm, Tavistock, for **Petherwin No. 26 7603**, born March 20, 1933, farrowed April 16, bred by H. R. Jasper, East Petherwin Farm, South Petherwin; *s.* Trolvis Ben 11th 2328, *d.* Lidcutt Vanity 6th 6761 *by* Lumburn Lad 5th 1732.

Class 424.—*Long White Lop-Eared Sows, born in* 1934.

3038 I.—G. H. EUSTICE, Bezurrel, Gwinear, Hayle, for **Bezurrel Alacrity 31st 7997**, born June 3; *s.* Trolvis Ben 15th 2616, *d.* Bezurrel Alacrity 19th 7125 *by* Afton Gay Boy 1122.

Class 425.—*Long White Lop-Eared Sows, born in* 1935.

3040 I. & R.N. for Champion.[3]—G. H. EUSTICE, Bezurrel, Gwinear, Hayle, for **Bezurrel Ruby 9th 7993**, born Jan. 1; *s.* Bezurrel Bacon Boy 43rd 2718, *d.* Bezurrel Ruby 1st 7063 *by* Forest Pattern 1st 2204.

3041 II.—G. H. EUSTICE, for **Bezurrel Ruby 10th 7995**, born Jan. 1; *s.* Bezurrel Bacon Boy 43rd 2718, *d.* Bezurrel Ruby 1st 7063 *by* Forest Pattern 1st 2204.

3043 III.—W. H. NEAL, Walreddon Farm, Tavistock, for **Yealmpston Dainty 8th**, born Jan. 13; *s.* Treringey Captain 2nd 2494, *d.* Petherwin No. 24 of 1933 7599 *by* Trolvis Ben 11th 2328.

Welsh.

Class 426.—*Welsh Boars, born in* 1934 *or* 1935.

3045 I.—R. EWART OWEN, Tanlan Hall Home Farm, Prestatyn, for **Prestatyn King 265 (D.U. 30)**, born Jan. 15, 1934; *s.* Prestatyn Gay Boy 1st 117, *d.* Prestatyn Lucy 8th 280 *by* Forest Pattern 17th 57.

3046 II.—WYNDHAM T. VINT, Thorn Cottage, Wroot, Doncaster, for **Emlyn Hedog 266 (V.T. 21)**, born June 16, 1934; *s.* Prestatyn Hedog 188, *d.* Prestatyn Fairy 2nd 476 *by* Prestatyn Derwen 146.

3044 III.—R. EWART OWEN, for **Prestatyn Jubilee 1st (D.U. 1)**, born Jan. 1, 1935; *s.* Prestatyn Gay Boy 1st 117, *d.* Prestatyn Lucy 19th 343 *by* Trevellyr Peter 58.

Class 427.—*Welsh Breeding Sows, born in or before* 1933.

3047 I.—R. EWART OWEN, Tanlan Hall Home Farm, Prestatyn, for **Prestatyn Lucy 5th 181 (D.U. 5)**, born Jan. 2, 1931, farrowed Jan. 15; *s.* Forest Pattern 17th 57, *d.* Hedog Lucy 81 *by* Penback Cymro 34.

3049 II.—WYNDHAM T. VINT, Thorn Cottage, Wroot, Doncaster, for **Dinam Impartial 288 (B.U. 687)**, born Jan. 2, 1933, farrowed Jan. 4, bred by Dinam Estates, Ltd., Llandinam, Mont.; *s.* Forest Pattern 17th 57, *d.* Dinam Ethel 27 *by* Penback Cymro 4th 37.

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[1] Champion Silver Medal given by the National Long White Lop-Eared Pig Society for the best Boar.

[2] The "Risingholme" Silver Challenge Cup given through the National Long White Lop-Eared Pig Society for the best Long White Lop-Eared Pig.

[3] Champion Silver Medal given by the National Long White Lop-Eared Pig Society for the best Sow.

3050 III.—T. M. WILLIAMS, Brechfa, Clynderwen, for **Brechfa Lady** 330 (T.W. 4), born Jan. 31, 1931, farrowed Feb. 1; *s.* Dyffryn Taf 19th 1584, *d.* Llan Lizzie 96 *by* Penback Cymro 34.

3048 R.N.—R. EWART OWEN, for **Prestatyn Lucy 8th.**

Class 428.—*Welsh Sows, born in* 1934.[1]

3053 I.—R. EWART OWEN, Tanlan Hall Home Farm, Prestatyn, for **Prestatyn Jolly Girl 3rd** 680 (D.U. 184), born July 26; *s.* Prestatyn Control 121, *d.* Prestatyn Lucy 5th 181 *by* Forest Pattern 17th 57.
3051 II.—R. EWART OWEN, for **Prestatyn Jolly Girl 1st** 678 (D.U. 154), born July 16; *s.* Prestatyn Gay Boy 1st 117, *d.* Prestatyn Lucy 4th 180 *by* Forest Pattern 17th 57.
3052 III.—R. EWART OWEN, for **Prestatyn Jolly Girl 2nd** 679 (D.U. 42), born Jan. 20 *s.* Prestatyn Derwen 146, *d.* Prestatyn Gay Lady 1st 281 *by* Derwen Gay Boy 64.
3054 R.N.—T. M. WILLIAMS, Brechfa, Clynderwen, for **Brechfa Lily.**

Class 429.—*Welsh Sows, born in* 1935.

3056 I.—R. EWART OWEN, Tanlan Hall Home Farm, Prestatyn, for **Prestatyn Queen Mary 2nd** (D.U. 8), born Jan. 1; *s.* Prestatyn Gay Boy 1st 117, *d.* Prestatyn Lucy 19th 343 *by* Trevellyr Peter 58.
3055 II.—R. EWART OWEN, for **Prestatyn Queen Mary 1st** (D.U. 7), born Jan. 1; *s.* Prestatyn Gay Boy 1st 117, *d.* Prestatyn Lucy 19th 343 *by* Trevellyr Peter 58.
3057 III.—T. M. WILLIAMS, Brechfa, Clynderwen, for **Brechfa Agnes** (T.W. 56), born Feb. 26; *d.* Derwen Marksman 152, *d.* Brechfa Megan 461 *by* Derwen Bacon Boy 120.

Bacon Pigs.

Class 430.—*Two Bacon Pigs of any Pure Breed, not less than* 200 *lb. and not exceeding* 230 *lb. each live weight.*

3066 I.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford. (Large White.)
3064 II.—A. E. LAW, Newborough, Peterborough. (Large White.)
3071 III. & 3072 V.—R. SILCOCK & SONS, LTD., Thornton Hall Farm, Thornton-le-Fylde, Blackpool. (Large White.)
3063 IV.—EDINBURGH UNIVERSITY INSTITUTE OF ANIMAL GENETICS, Shothead, Balerno. (Large White.)

Class 431.—*Two Bacon Pigs, First Cross between any Pure Breeds, not less than* 200 *lb. and not exceeding* 230 *lb. each live weight.*

3080 I. & 3081 III.—R. SILCOCK & SONS, LTD., Bainesse, Catterick. (*s.* Large White, *d.* Essex.)
3074 II.—H. R. DAVIDSON, Common Lane, Batford, Harpenden. (*s.* Tamworth, *d.* Large White.)
3079 R.N.—A. E. LAW, Newborough, Peterborough.

Porkers.

Class 432.—*Two Pigs of any Pure Breed, above* 100 *lb. and not exceeding* 140 *lb. each live weight.*

3097 I.—JOHN WHITFIELD, Earsdon Grange, Earsdon, Northumberland. (Large White.)
3091 II.—A. E. LAW, Newborough, Peterborough. (Large White.)
3095 III.—R. SILCOCK & SONS, LTD., Bainesse, Catterick. (Large White.)
3087 IV.—T. H. GLADSTONE, Eastcote Grange, Hampton-in-Arden. (Middle White.)
3084 V.—ERNEST A. CROOKES, Rose Cottage Farm, Cutthorpe. Chesterfield. (Large White.)

Class 433.—*Two Pigs, First Cross between any Pure Breeds, above* 100 *lb. and not exceeding* 140 *lb. each live weight.*

3102 I.—ERNEST HARDING, Packwood Grange, Dorridge, Birmingham. (*s.* Large White, *d.* Wessex.)
3098 II. & 3099 III.—H. R. DAVIDSON, Common Lane, Batford, Harpenden. (*s.* Large White, *d.* Berkshire.)
3104 R.N.—R. SILCOCK & SONS, LTD., Bainesse, Catterick.

[1] Prizes given by the Welsh Pig Society.

POULTRY.

By "Cock" and "Hen" are meant birds hatched previous to January 1, 1935; and by "Cockerel" and "Pullet" are meant birds hatched in 1935.

The Prizes in each Class are as follows: **First Prize, 30s.; Second Prize, 20s.; Third Prize, 10s.; Fourth Prize, 5s.**

Special Prizes were given in the Poultry Classes by the following Clubs: Croad Langshan, Sussex, Columbian Wyandotte, Buff Orpington, British Jersey Giant, British Black Barnevelder, British Barnevelder, Rhode Island Red, Plymouth Rock and Welsummer.

"P.F." stands for "Poultry Farm."

Class 434.—*Dorking Cocks or Cockerels.*

3 I.—Sir Duncan Watson, Homelea, Leigh Green, Reigate.
1 II. & 4 III.—A. J. Major, Ditton, Langley, Bucks.
2 IV.—V. A. Bayley, Upper Millichope, Church Stretton.

Class 435.—*Dorking Hens or Pullets.*

5 I.—John Walker, Skinners Steps, Cupar, Fife.
7 II.—Sir Duncan Watson, Homelea, Leigh Green, Reigate.
8 III. & 6 IV.—A. J. Major, Ditton, Langley, Bucks.

Class 436.—*Croad Langshan Cocks or Cockerels.*

12 I. & Special.—R. Anthony, Euxton, Chorley, Lancs.
13 II. & R.N. for Special.—Harold Church, Godshill, Fordingbridge, Hants.
11 III.—K. J. Fawcett, 7, Hebble Gardens, Wheatley, Halifax.

Class 437.—*Croad Langshan Hens or Pullets.*

15 I. & Special.—Sir Duncan Watson, Homelea, Leigh Green, Reigate.
14 II. & R.N. for Special.—R. Anthony, Euxton, Chorley, Lancs.
16 III. & 18 IV.—Harold Church, Godshill, Fordingbridge, Hants.

Class 438.—*Brahma or Cochin Cocks or Cockerels.*

21 I.—William Kean, Willow Bank, Middleton, Lancs.
19 II.—Sir Duncan Watson, Homelea, Leigh Green, Reigate.
20 III.—H. Martin Wright, The Poplars, Great Shelford, Cambridge.
22 IV.—R. M. Thomas, 1, Glasfryn, Cockett, Sketty, Swansea.

Class 440.—*Red or White Sussex Cocks or Cockerels.*

29 I., 31 IV. & 23 R.N.—J. Dumbleton, Sheen Croft Farm, Didcot, Berks.
30 II.—R. W. Carson, Hookwood Manor, Horley, Surrey.
27 III.—S. E. Quenby, Park House, Hitchin, Herts.
H.C.—28. C.—25.

Class 441.—*Red or White Sussex Hens or Pullets.*

34 I. & R.N. for Special, 39 IV. & 41 R.N.—J. Dumbleton, Sheen Croft Farm, Didcot.
32 II.—Capt. T. M. Whittaker, Pen-y-Bryn Farm, Portmadoc.
40 III.—R. W. Carson, Hookwood Manor, Horley, Surrey.
H.C.—36. C.—35.

Class 443.—*Light Sussex Hens.*

45 I.—Frank Hodges, Cole Orton Farm, Leicester.
44 II.—Mrs. A. E. Jenkins, Wherwell P.F., Longparish, Hants.
43 III.—Edmund Holt, The Limes, Pulford, Wrexham.
46 IV.—Henry Underwood & Son, Mowshurst P.F., Edenbridge.
42 R.N.—J. S. Worsley, The Cottage, Old Thornaby-on-Tees.

Class 444.—*Light Sussex Cockerels.*

52 I. & R.N. for Cup.[1]—Mrs. A. E. Jenkins, Wherwell P.F., Longparish, Hants.
57 II.—Frank Hodges, Cole Orton Farm, Leicester.
49 III.—Capt. T. M. Whittaker, Pen-y-Bryn Farm, Portmadoc.
53 IV.—Henry Underwood & Son, Mowshurst P.F., Edenbridge.
54 R.N.—Sir Duncan Watson, Homelea, Leigh Green, Reigate.
H.C.—56. C.—47.

Class 445.—*Light Sussex Pullets.*

70 I. Special & Cup.[1]—Capt. T. M. Whittaker, Pen-y-Bryn Farm, Portmadoc.
62 II.—Sir Duncan Watson, Homelea, Leigh Green, Reigate.
71 III.—Mr. & Mrs. R. P. Harbottle, Albion House, Great Ayton.
69 IV.—Col. D. A. Chaytor, Pooley Hall, Polesworth, Tamworth.
65 R.N.—Frank Hodges, Cole Orton Farm, Leicester.
H.C.—61, 67, 72. C.—59.

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[1] The "Crawshay Memorial" Cup given through the Sussex Poultry Club for the best Light Sussex.

Class 447.—*Speckled Sussex Hens.*

73 I.—Sir Herbert Sharp, Bart., Morley P.F., Hasketon, Woodbridge.
75 II.—Capt. T. M. Whittaker, Pen-y-Bryn Farm, Portmadoc.
74 III.—Mrs. F. M. Heathfield, The Vale P.F., Plungar, Nottingham.

Class 449.—*Speckled Sussex Pullets.*

80 I. & 77 III.—Capt. T. M. Whittaker, Pen-y-Bryn Farm, Portmadoc.
78 II.—Mrs. F. M. Heathfield, The Vale P.F., Plungar, Nottingham.
79 IV.—John Barton, Burtree House, Hutton, Sessay, Thirsk.

Class 452.—*White Wyandotte Cocks or Cockerels.*

84 I.—R. Anthony, Euxton, Chorley, Lancs.
82 II.—Capt. E. Duckworth, Merriewood P.F., Crawley Down.
81 III.—Mr. & Mrs. R. P. Harbottle, Albion House, Great Ayton.
85 IV.—Sir Duncan Watson, Homelea, Leigh Green, Reigate.

Class 453.—*White Wyandotte Hens or Pullets.*

86 I.—Mr. & Mrs. R. P. Harbottle, Albion House, Great Ayton.
88 II.—R. Anthony, Euxton, Chorley, Lancs.
87 III.—Capt. E. Duckworth, Merriewood P.F., Crawley Down.
89 IV.—F. J. Ainscough, Briars Hall, Lathom, Ormskirk.

Class 455.—*Columbian Wyandotte Hens or Pullets.*

93 I. & Cup.[1]—Fred Brown, Woodside, Grimscar, Huddersfield.
91 II. & R.N. for Cup.[1]—J. Dickinson & Son, Hedgeways, Kemsing, Sevenoaks.
95 III. & 92 IV.—W. A. Slocock, Goldsworth Orchard, St. John's, Woking.
94 R.N.—The Marchioness of Normanby, Mulgrave Castle, Lythe, Whitby.

Class 456.—*Gold or Silver Laced Wyandotte Cocks or Cockerels.*

96 I.—R. Anthony, Euxton, Chorley, Lancs.
99 II.—William Morgan, Balcurvie, Windygates, Fife.
98 III.—Herbert Spensley, Oaks Farm, Menston-in-Wharfedale.
97 IV.—W. Mayer, Biddulph Park, Stoke-on-Trent.

Class 457.—*Gold or Silver Laced Wyandotte Hens or Pullets.*

104 I.—Herbert Spensley, Oaks Farm, Menston-in-Wharfedale.
105 II.—R. Whitehead, Bonehill, Tamworth.
102 III.—W. Mayer, Biddulph Park, Stoke-on-Trent.
101 IV.—Miss Telford, Breconside, Brampton, Cumberland.
103 R.N.—Arthur Ellett, Theobald P.F., Boreham Wood, Elstree.

Class 459.—*Wyandotte Hens or Pullets, any other colour.*

109 I.—Roger Hargreaves, Abbeydene P.F., Whalley, Lancs.
106 II.—Mrs. W. G. Jacka, Ninnis, Germoe, Marazion.
108 III.—R. Anthony, Euxton, Chorley, Lancs.
107 IV.—James Wallbank, Belmont, Longridge, Preston.

Class 460.—*Buff Orpington Cocks or Cockerels.*

112 I. & Special.—R. Anthony, Euxton, Chorley, Lancs.
110 II. & R.N. for Special & 113 III.—W. J. Golding, Bowens, Penshurst, Kent.
111 IV.—Alex. Reith, Barbieston Cottage, Dalrymple.

Class 462.—*Black Orpington Cocks or Cockerels.*

114 I., 118 II. & 116 III.—John Burdett, 1, Lake Bank Terrace, Wingate, Co. Durham.
115 IV.—Mr. & Mrs. R. P. Harbottle, Albion House, Great Ayton.

Class 463.—*Black Orpington Hens or Pullets.*

121 I., 120 II. & 123 IV.—John Burdett, 1, Lake Bank Terrace, Wingate, Co. Durham.
119 III.—H. E. Caldwell, Crag House, Boothstown, Manchester.

Class 465.—*Orpington Hens or Pullets, any other colour.*

125 I.—Sir Duncan Watson, Homelea, Leigh Green, Reigate.
124 II., 127 III. & 126 IV.—Tom Trigg, The Oak, Anthill, Denmead, Cosham, Hants.

Class 468.—*British Jersey Giant Cocks or Cockerels.*

128 I. & R.N. for Special & 131 II.—Mrs. Allen, Newton Hall, Gargrave, Skipton.
132 III.—Harry Fox, International Poultry Yards, Matlock.
129 IV.—James Cowans, Deneville, Wooler.
130 R.N.—W. Grubb, Lower Crabb P.F., Five Ashes, Sussex.

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[1] The "Goddard" Visiting Cup given by the Columbian Wyandotte Club for the best Columbian Wyandotte.

Class 469.—*British Jersey Giant Hens or Pullets.*

134 I. & Special.—JAMES COWANS, Deneville, Wooler.
136 II.—W. GRUBB, Lower Crabb P.F., Five Ashes, Sussex.
133 III.—D. J. INSLEY, Hunstanton, Norfolk.
137 IV.—HARRY FOX, International Poultry Yards, Matlock.

135 R.N.—MRS. ALLEN, Newton Hall, Gargrave, Skipton.

Class 470.—*Black Barnevelder Cocks or Cockerels.*

141 I. & Special.—HARRY FOX, International Poultry Yards, Matlock.
139 II. & R.N. for Special.—J. E. COWCILL, Silkstone Main P.F., Silkstone Common, Barnsley.
140 III. & 142 R.N.—WALTER C. PAYNE, The Chalet, Weston, Hitchin.
138 IV.—MRS. E. A. RUSSELL, The Grange, Sewardstone Road, Waltham Abbey.

Class 471.—*Black Barnevelder Hens or Pullets.*

144 I. & Special.—MR. & MRS. R. P. HARBOTTLE, Albion House, Great Ayton.
146 II. & R.N. for Special.—HARRY FOX, International Poultry Yards, Matlock.
143 III.—TOM CLOUGH, The P.F., Gawsworth, Macclesfield.
145 IV.—WALTER C. PAYNE, The Chalet, Weston, Hitchin.

Class 472.—*Barnevelder Cocks or Cockerels, any other colour.*

150 I. & Special.—CAPT. E. DUCKWORTH, Merriewood P.F., Crawley Down.
151 II.—L. D. CHATT & SONS, Silksworth Row, Sunderland.
148 III.—JOHN NELSON, JUN., Stones House, Todmorden.
149 IV.—FRANK HODGES, Cole Orton Farm, Leicester.

147 R.N.—J. E. COWCILL, Silkstone Main P.F., Silkstone Common, Barnsley.

Class 473.—*Barnevelder Hens or Pullets, any other colour.*

155 I. & R.N. for Special.—J. E. COWCILL, Silkstone Main P.F., Silkstone Common, Barnsley.
152 II.—FRANK HODGES, Cole Orton Farm, Leicester.
158 III.—WILLIAM MORGAN, Balcurvie, Windygates, Fife.
156 IV.—CAPT. E. DUCKWORTH, Merriewood P.F., Crawley Down.

154 R.N.—H. RIVERS, 195, Croydon Road, Anerley, London, S.E.
H.C.—157. C.—153.

Class 474.—*Rhode Island Red Cocks.*

164 I. & Special.—G. EXELBY, 97, Poppleton Road, York.
162 II.—SIR HERBERT SHARP, BART., Morley P.F., Hasketon, Woodbridge.
161 III.—NIGEL H. HAMBRO, Coldham Hall, Bury St. Edmunds.
159 IV.—JOHN G. WILLIAMSON, Chester Road, Middlewich.

163 R.N.—FRANK H. PAGE, Woodlands, Great Horkesley, Colchester.
H.C.—160. C.—166.

Class 475.—*Rhode Island Red Hens.*

172 I. & Special.—JOHN G. WILLIAMSON, Chester Road, Middlewich.
169 II.—RICHARD MOORE, Hammer House, Sutton Bridge, Wisbech.
170 III.—DAVID ELLIS, Ffordd Farm, Glan Conway, North Wales.
174 IV.—FRANK H. PAGE, Woodlands, Great Horkesley, Colchester.

171 R.N.—W. R. ABBEY & SON, Croft Farm, Hessay, York.
H.C.—173.

Class 476.—*Rhode Island Red Cockerels.*

176 I. & R.N. for Special.—W. R. ABBEY & SON, Croft Farm, Hessay, York.
178 II.—JOHN DARNELL, Sunnymede, Rampton, Retford.
177 III.—SIR HERBERT SHARP, BART., Morley P.F., Hasketon, Woodbridge.
180 IV.—RICHARD MOORE, Hammer House, Sutton Bridge, Wisbech.

181 R.N.—FRANK H. PAGE, Woodlands, Great Horkesley, Woodbridge.

Class 477.—*Rhode Island Red Pullets.*

192 I. & R.N. for Special.—JOHN DARNELL, Sunnymede, Rampton, Retford.
188 II.—FRANK H. PAGE, Woodlands, Great Horkesley, Woodbridge.
194 III. & 190 R.N.—RICHARD MOORE, Hammer House, Sutton Bridge, Wisbech.
185 IV.—JOHN G. WILLIAMSON, Chester Road, Middlewich.

H.C.—183. C.—186.

Class 478.—*Barred Plymouth Rock Cocks.*

196 I. & 200 III.—EDGAR HIRST, Oak Lees, New Mill, Huddersfield.
199 II.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.
198 IV.—R. MAJOR, Kirkby Lonsdale.

197 R.N.—JAMES D. ORR, Gargunnock, Stirling.

Class 479.—*Barred Plymouth Rock Hens.*

202 I. & 206 R.N.—E. W. ALLENBY, Three Oaks, Virginia Water.
207 II.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.
201 III.—MRS. W. G. JACKA, Ninnis, Germoe, Marazion.
203 IV.—T. H. NELSON, Kirkby Lonsdale.
H.C.—205.

Class 480.—*Barred Plymouth Rock Cockerels.*

215 I. & Special.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.
213 II.—J. FAWCETT, Eldron House, Ingleton, Carnforth.
209 III.—JOHN TAYLOR, Heath Farm, Tiptree, Essex.
208 IV.—F. H. HAYTON, Levensfield, Silverdale, Lancs.
211 R.N.—MRS. F. S. WILLIAMS, Cofton P.F., West Heath, Northfield, Birmingham.
H.C.—214.

Class 481.—*Barred Plymouth Rock Pullets.*

216 I. & R.N. for Special.—JOHN TAYLOR, Heath Farm, Tiptree, Essex.
224 II.—R. MAJOR, Kirkby Londsale.
222 III. & 217 R.N.—EDGAR HIRST, Oak Lees, New Mill, Huddersfield.
221 IV.—J. FAWCETT, Eldron House, Ingleton, Carnforth.
H.C.—219, 220, 225.

Class 482.—*Buff Plymouth Rock Cocks or Cockerels.*

229 I. & R.N. for Special.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.
226 II.—JOHN H. THORNTON, Hornby House, Cabus, Garstang.
231 III.—BILSBOROUGH & BLAND, Park Lane P.F., Forton, Preston.
227 IV. & 232 R.N.—MRS. M. FORSYTH-THOMPSON, White Heather, Ringsfield, Beccles.
H.C.—228.

Class 483.—*Buff Plymouth Rock Hens or Pullets.*

236 I. & Special.—BILSBOROUGH & BLAND, Park Lane P.F., Forton, Preston.
237 II.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.
234 III.—THOMAS ATKINSON, Croft P.F., Burton-in-Lonsdale, Carnforth.
233 IV.—ANDREW SOUTHERIN, 88, Burnley Road, Padiham, Lancs.

Class 484.—*Plymouth Rock Cocks or Cockerels, any other colour.*

242 I. & R.N. for Special.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.
240 II.—JAMES D. ORR, Gargunnock, Stirling.
238 III.—W. R. ABBEY & SON, Croft Farm, Hessay, York.
241 IV.—CAPT. E. DUCKWORTH, Merriewood P.F., Crawley Down.
239 R.N.—JOHN TAYLOR, Heath Farm, Tiptree, Essex.

Class 485.—*Plymouth Rock Hens or Pullets, any other colour.*

247 I. & Special.—JAMES D. ORR, Gargunnock, Stirling.
246 II.—W. R. ABBEY & SON, Croft Farm, Hessay, York.
243 III.—E. W. ALLENBY, Three Oaks, Virginia Water.
245 IV.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.

Class 486.—*Old English Game Black-red Cocks or Cockerels.*

249 I.—A. SLATER, The Old Vicarage, Lythe, Whitby.
256 II.—ROBERT KERR, Westcragg, Loop Road, Whitehaven.
252 III.—J. G. BLAIR, 71, Market Place, Wigton.
253 IV.—JAMES BELL, 1, Main Street, Egremont.
251 R.N.—JOS. J. ARMSTRONG, Bar Close, Scaleby, Carlisle.
H.C.—250, 257, 258. C.—248, 254.

Class 487.—*Old English Game Clay or Wheaten Hens or Pullets.*

264 I.—JOS. J. ARMSTRONG, Bar Close, Scaleby, Carlisle.
266 II.—A. SLATER, The Old Vicarage, Lythe, Whitby.
267 III.—J. G. BLAIR, 71, Market Place, Wigton.
262 IV.—GREENHOW & HARTLEY, Galaberry P.F., Annan.
261 R.N.—JAMES BELL, 1, Main Street, Egremont.
H.C.—259, 260. C.—263, 265.

Class 488.—*Old English Game Cocks or Cockerels, any other colour.*

275 I.—GREENHOW & HARTLEY, Galaberry P.F., Annan.
271 II.—WILLIAM TELFORD, Breconside, Brampton, Cumberland.
270 III. & 276 IV.—A. SLATER, The Old Vicarage, Lythe, Whitby.
272 R.N.—WILLIAM FENDER, 74, Station Road, North Broomhill, Morpeth.
H.C.—269, 273. C.—274.

Class 489.—*Old English Game Hens or Pullets, any other colour.*

279 I.—GREENHOW & HARTLEY, Galaberry P.F., Annan.
280 II.—JOS. J. ARMSTRONG, Bar Close, Scaleby, Carlisle.
281 III.—A. SLATER, The Old Vicarage, Lythe, Whitby.
277 IV.—CAPT. E. GILES BATES, Heatheridge, Humshaugh, Northumberland.

278 R.N.—CAPT. C. W. WILSON, Kirkland House, Wigton.
H.C.—282. C.—283, 284.

Class 490.—*Indian Game Cocks or Cockerels.*

289 I.—J. H. BAKER & SON, Windyash, Barnstaple.
286 II.—CECIL BRENT, Clampit, Callington, Cornwall.
287 III.—K. J. G. HAWKEY, Treharrock, Wadebridge.
288 IV.—W. E. PLATTEN, Hill Farm, Little Ryburgh, Fakenham.

Class 491.—*Indian Game Hens or Pullets.*

290 I.—CECIL BRENT, Clampit, Callington, Cornwall.
292 II.—K. J. G. HAWKEY, Treharrock, Wadebridge.
293 III.—W. E. PLATTEN, Hill Farm, Little Ryburgh, Fakenham.
291 IV.—J. H. BAKER & SON, Windyash, Barnstaple.

Class 492.—*Faverolles Cocks or Cockerels.*

303 I., 296 III. & 299 IV.—H. W. BIDDLECOMBE, Prestberries, Hartpury, Gloucester.
301 II.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.

294 R.N.—I. G. L. ALEXANDER, Hopesay House, Aston-on-Clun.

Class 493.—*Faverolles Hens or Pullets.*

310 I.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.
308 II. & 305 IV.—I. G. L. ALEXANDER, Hopesay House, Aston-on-Clun.
309 III. & 306 R.N.—C. H. BRADLEY, Tibberton, Gloucester.

Class 495.—*Minorca Hens or Pullets.*

314 I.—JAMES ANDERSON, Kirkhall, Ardrossan, Ayrshire.
318 II. & 315 IV.—WILLIAM J. SEWELL, Gateletts, Culgaith, Penrith.
319 III.—A. G. F. PITTS, Alvechurch, Birmingham.

316 R.N.—G. T. PORRITT, 144, New Hey Road, Huddersfield.
H.C.—313.

Class 496.—*Leghorn Cocks or Cockerels.*

320 I.—R. ANTHONY, Euxton, Chorley, Lancs.
323 II.—SIR DUNCAN WATSON, Homelea, Leigh Green, Reigate.
321 III.—MRS. GRAHAM, Wallacetown Cottages, Gasstown, Dumfries.
322 IV.—R. W. KEEN, The Factory, Castle Eden.

Class 497.—*Leghorn Hens or Pullets.*

327 I.—SIR DUNCAN WATSON, Homelea, Leigh Green, Reigate.
326 II.—MR. & MRS. R. P. HARBOTTLE, Albion House, Great Ayton.
324 III.—R. ANTHONY, Euxton, Chorley, Lancs.
332 IV.—H. SPENCER, Leghorn Yard, Melksham.

328 R.N.—MRS. GRAHAM, Wallacetown Cottages, Gasstown, Dumfries.
H.C.—329. C.—325.

Class 498.—*Ancona Cocks or Cockerels.*

337 I.—R. ANTHONY, Euxton, Chorley, Lancs.
339 II.—A. BRIDGE, Hall Hill Farm, Rawtenstall, Rossendale.
338 III.—ANDREW SOUTHERIN, 88, Burnley Road, Padiham, Lancs.
334 IV.—A. RICE, Wollaston, Wellingborough.

335 R.N.—EDMUND HOLT, The Limes, Pulford, Wrexham.
H.C.—333. C.—340.

Class 499.—*Ancona Hens or Pullets.*

343 I.—R. ANTHONY, Euxton, Chorley, Lancs.
342 II.—ANDREW SOUTHERIN, 88, Burnley Road, Padiham, Lancs.
347 III.—A. BRIDGE, Hall Hill Farm, Rawtenstall, Rossendale.
345 IV.—J. H. BAKER & SON, Windyash, Barnstaple.
341 R.N.—A. RICE, Wollaston, Wellingborough.
H.C.—346. C.—348.

Class 501.—*Redcap Hens or Pullets.*

350 I. & 353 II.—HARRY FOX, International Poultry Yards, Matlock.
352 III.—T. H. MARTIN, New Road, Middleton-by-Wirksworth.
351 IV.—JAMES FOX, 2, Undercliff, Bakewell.

349 R.N.—H. HEATH, Bakewell.

Class 506.—*Cocks, any other distinct variety, except Bantams.*

361 I.—R. ANTHONY, Euxton, Chorley, Lancs. Hamburgh.
357 II.—DR. T. W. E. ROYDEN, Fleggburgh, Norfolk. Sumatra.
355 III.—R. FLETCHER HEARNSHAW, Burton Joyce, Nottingham. Scots Grey.
362 IV.—JOHN AYRTON, Brighouse, Yorks. Langshan.
359 R.N.—E. MORTON, South View, Mickleton, Yorks. Old English Pheasant Fowl.
H.C.—358, 360.

Class 507.—*Hens, any other distinct variety, except Bantams.*

372 I.—R. ANTHONY, Euxton, Chorley, Lancs. Langshan.
373 II.—HARRY FORTUNE, Banklands, Silsden, Keighley. Hamburgh.
366 III.—J. F. ENTWISLE, Crigglestone Manor, Wakefield. Modern Game.
364 IV.—SIR DUNCAN WATSON, Homelea, Leigh Green, Reigate. Hamburgh.
370 R.N.—CHARLES HARGREAVES, Cow Hey Farm, Great Harwood, Blackburn. Andalusian.
H.C.—365, 367, 368, 369. C.—371.

Class 509.—*Pullets, any other distinct variety, except Bantams.*

376 I.—HARRY FORTUNE, Banklands, Silsden, Keighley. Hamburgh.
374 II.—J. PICKERILL, Moorside, Madeley, Crewe. Langshan.
375 III.—MAJOR G. T. WILLIAMS, Tredrea, Perranwell. Frizzle.
377 IV.—MAJOR G. T. WILLIAMS. Polish.

Class 510.—*White Wyandotte Utility Cocks or Cockerels.*

383 I.—R. ANTHONY, Euxton, Chorley, Lancs.
379 II.—SIR DUNCAN WATSON, Homelea, Leigh Green, Reigate.
378 III.—CAPT. E. DUCKWORTH, Merriewood P.F., Crawley Down.
385 IV.—FRED THOMPSON, P.F., Eyam, Sheffield.
381 R.N.—JOHN LIVINGSTONE, Peelhill, Darvel, Ayrshire.
H.C.—384. C.—380.

Class 511.—*White Wyandotte Utility Hens or Pullets.*

390 I.—R. ANTHONY, Euxton, Chorley, Lancs.
386 II.—MRS. JOHN FANE, Swalcliffe Pedigree Poultry Farm, Banbury.
392 III.—SIR DUNCAN WATSON, Homelea, Leigh Green, Reigate.
395 IV.—FRED THOMPSON, P.F., Eyam, Sheffield.
389 R.N.—CAPT. E. DUCKWORTH, Merriewood P.F., Crawley Down.
H.C.—394. C.—391.

Class 512.—*White Leghorn Utility Cocks or Cockerels.*

399 I.—FRED THOMPSON, P.F., Eyam, Sheffield.
396 II.—CAPT. E. DUCKWORTH, Merriewood P.F., Crawley Down.
398 III.—R. ANTHONY, Euxton, Chorley, Lancs.
397 IV.—H. K. MICHAEL & SON, Eau Bank P.F., North Somercotes, Louth, Lincs.

Class 513.—*White Leghorn Utility Hens or Pullets.*

404 I.—FRED THOMPSON, P.F., Eyam, Sheffield.
402 II.—MR. & MRS. R. P. HARBOTTLE, Albion House, Great Ayton.
400 III.—F. J. CHESHIRE, 22, Wharf Road, Grantham.
401 IV.—H. K. MICHAEL & SON, Eau Bank P.F., North Somercotes, Louth, Lincs.
403 R.N.—R. ANTHONY, Euxton, Chorley, Lancs.

Class 514.—*Leghorn Utility Cocks or Cockerels, any other colour.*

411 I.—ROBERT MCPHERSON, Drumboy, Darvel, Ayrshire.
409 II.—R. ANTHONY, Euxton, Chorley, Lancs.
410 III.—HARRY FOX, International Poultry Yards, Matlock.
406 IV.—EDMUND HOLT, The Limes, Pulford, Wrexham.
407 R.N.—CAPT. E. DUCKWORTH, Merriewood P.F. Crawley Down.
H.C.—408.

Class 515.—*Leghorn Utility Hens or Pullets, any other colour.*

418 I.—CHARLES BERRY, Rose Bank, Lower Walton, Warrington.
412 II.—J. W. RICHARDSON, Eastfield P.F. Earsdon, Northumberland.
420 III.—HARRY FOX, International Poultry Yards, Matlock.
415 IV.—J. F. ENTWISLE, Crigglestone Manor, Wakefield.
413 R.N.—FRED RUSHFORD & SON, Etherley House, Wind Mill, Etherley, Bishop Auckland.
H.C.—419. C.—414.

Class 516.—*Sussex Utility Cocks or Cockerels.*

421 I.—SIR DUNCAN WATSON, Homelea, Leigh Green, Reigate.
429 II.—COL. D. A. CHAYTOR, Pooley Hall, Polesworth, Tamworth.
426 III.—EDMUND HOLT, The Limes, Pulford, Wrexham.
432 IV.—RALPH P. BURDETT, Wingate, Co. Durham.

423 R.N.—J. ORANGE, Hartford Bridge P.F., Bedlington.
H.C.—425. C.—431.

Class 517.—*Sussex Utility Hens or Pullets.*

434 I.—MR. & MRS. R. P. HARBOTTLE, Albion House, Great Ayton.
436 II.—WALTER WORRALL, Lyndon, Waggs Road, Congleton.
442 III.—MRS. A. E. JENKINS, Wherwell P.F., Longparish, Hants.
444 IV.—WILLIAM MORGAN, Balcurvie, Windygates, Fife.

441 R.N.—RALPH P. BURDETT, Wingate, Co. Durham.
H.C.—435. C.—437.

Class 518.—*Buff Plymouth Rock Utility Cocks or Cockerels.*

455 I. & Special.—BILSBOROUGH & BLAND, Park Lane P.F., Forton, Preston.
449 II.—R. ANTHONY, Euxton, Chorley, Lancs.
450 III.—JOHN TAYLOR, Heath Farm, Tiptree, Essex.
454 IV.—JAMES D. ORR, Gargunnock, Stirling.

453 R.N.—TOM CLOUGH, The P.F., Gawsworth, Macclesfield.
H.C.—446, 447, 448, 451.

Class 519.—*Buff Plymouth Rock Utility Hens or Pullets.*

462 I. & R.N. for Special.—R. ANTHONY, Euxton, Chorley, Lancs.
460 II.—JOHN HEALEY, Kiln Bank, Croft, Market Drayton.
461 III.—BILSBOROUGH & BLAND, Park Lane P.F., Forton, Preston.
459 IV.—JAMES D. ORR, Gargunnock, Stirling.

Class 520.—*Plymouth Rock Utility Cocks or Cockerels, any other colour.*

468 I.—W. W. BUTT, Eastfield P.F., North Thoresby, Lincs.
465 II.—JOHN TAYLOR, Heath Farm, Tiptree, Essex.
464 III.—W. R. ABBEY & SON, Croft Farm, Hessay, York.
466 IV.—E. W. ALLENBY, Three Oaks, Virginia Water.

467 R.N.—R. ANTHONY, Euxton, Chorley, Lancs.

Class 521.—*Plymouth Rock Utility Hens or Pullets, any other colour.*

474 I.—JOHN TAYLOR, Heath Farm, Tiptree, Essex.
473 II.—J. FAWCETT, Eldron House, Ingleton, Carnforth.
471 III.—JAMES D. ORR, Gargunnock, Stirling.
470 IV.—R. ANTHONY, Euxton, Chorley, Lancs.

472 R.N.—W. R. ABBEY & SON, Croft Farm, Hessay, York.
H.C.—475, 476.

Class 522.—*Rhode Island Red Utility Cocks or Cockerels.*

481 I. & Special.—LORD GREENWAY, Stanbridge Earls P.F., Romsey, Hants.
493 II. & R.N. for Special & 488 III.—JOHN KAY, Alderwood, Edenfield, Ramsbottom.
478 IV.—JOHN G. WILLIAMSON, Chester Road, Middlewich.

477 R.N.—THE EARL OF BRADFORD, Weston Park, Shifnal.
H.C.—482. C.—492.

Class 523.—*Rhode Island Red Utility Hens or Pullets.*

509 I. & Special.—RICHARD MOORE, Hammer House, Sutton Bridge, Wisbech.
502 II. & R.N. for Special.—JOHN KAY, Alderwood, Edenfield, Ramsbottom.
507 III.—EDMUND HOLT, The Limes, Pulford, Wrexham.
496 IV.—LORD GREENWAY, Stanbridge Earls P.F., Romsey, Hants.

499 R.N.—JOHN G. WILLIAMSON, Chester Road, Middlewich.
H.C.—498. C.—511.

Class 524.—*Welsummer Utility Cocks or Cockerels.*

518 I., Special & Cup, & 522 II. & R.N. for Special & Cup.—JOSEPH PURDHAM, 47, Harold Street, Currock, Carlisle.
514 III.—MRS. A. M. PAPE, Forest Lodge P.F., Binfield, Berks.
520 IV.—ROGER HARGREAVES, Abbeydene P.F., Whalley, Lancs.

515 R.N.—J. E. COWGILL, Silkstone Main P.F., Silkstone Common, Barnsley.
H.C.—516. C.—519.

Class 525.—*Welsummer Utility Hens or Pullets.*

526 I., Special & Cup.—JOHN NELSON, JUN., Stones House, Todmorden.
529 II. & R.N. for Special & Cup.—JAMES D. ORR, Gargunnock, Stirling.
531 III.—AMOS PICKARD, The G. E. P. Farm, Bull Ring, Chilvers Coton, Nuneaton.
527 IV.—MRS. A. M. PAPE, Forest Lodge P.F., Binfield, Berks.
524 R.N.—K. CLEMENT, Bucklands Pedigree Stock Farm, Nailsea, Somerset.
H.C.—523. C.—530.

Class 527.—*Utility Light Hens or Pullets, any other variety.*

535 I.—SAMUEL BROOKS, Hepzibah Farm, Irlam, Manchester. Ancona.
537 II.—HARRY FORTUNE, Banklands, Silsden, Keighley. Hamburgh.
533 III.—R. ANTHONY, Euxton, Chorley, Lancs. Ancona.
532 IV.—FRED RUSHFORD & SON, Etherley House, Wind Mill, Etherley, Bishop Auckland. Ancona.
534 R.N.—JOSEPH BLACKBURN, Craven Nursery, Thorton-in-Craven, Skipton.
H.C.—536.

Class 528.—*Utility Heavy Cocks or Cockerels, any other variety.*

541 I.—SIR DUNCAN WATSON, Homelea, Leigh Green, Reigate. Croad Langshan.
540 II.—R. ANTHONY, Euxton, Chorley, Lancs. Croad Langshan.
539 III.—A. J. MAJOR, Ditton, Langley, Bucks. Dorking.
538 IV.—W. J. GOLDING, Bowens, Penshurst, Kent. Buff Orpington.

Class 529.—*Utility Heavy Hens or Pullets, any other variety.*

542 I.—W. J. GOLDING, Bowens, Penshurst, Kent. Buff Orpington.
544 II.—F. J. CHESHIRE, 22, Wharf Road, Grantham. Australorp.
543 III.—R. ANTHONY, Euxton, Chorley, Lancs. Croad Langshan.
545 IV.—A. J. MAJOR, Ditton, Langley, Bucks. Dorking.

Class 531.—*Utility Heavy Hens.*[1]

547 I.—SIR DUNCAN WATSON, Homelea, Leigh Green, Reigate. White Wyandotte.
546 II.—FRANCIS J. MARSTON, Biddenden P.F., Biddenden, Kent. White Sussex.
549 III.—MRS. BEAUMONT HOTHAM, Milne Graden P.F., Coldstream. White Wyandotte.

Class 534.—*Aylesbury, Pekin or Rouen Drakes.*

554 I.—R. ANTHONY, Euxton, Chorley, Lancs. Rouen.
551 II. & 555 IV.—JAMES HUNTLY & SON, Hirsel P.F., Coldstream. Aylesbury.
552 III.—REGINALD APPLEYARD, Priory Waterfowl Farm, Ixworth, Bury St. Edmunds. Pekin.
553 R.N.—J. ORANGE, Hartford Bridge P.F., Bedlington. Aylesbury.

Class 535.—*Aylesbury, Pekin or Rouen Ducks.*

556 I. & 560 III.—JAMES HUNTLY & SON, Hirsel P.F., Coldstream. Aylesbury.
561 II.—R. ANTHONY, Euxton, Chorley, Lancs. Rouen.
557 IV.—EDMUND HOLT, The Limes, Pulford, Wrexham. Aylesbury.
559 R.N.—REGINALD APPLEYARD, Priory Waterfowl Farm, Ixworth, Bury St. Edmunds. Pekin.

Class 536.—*Indian Runner Drakes or Ducks, bred prior to* 1935.

569 I.—R. ANTHONY, Euxton, Chorley, Lancs.
567 II.—COLIN CAMPBELL, Swale Villa, Maunby, Thirsk.
568 III.—FRED ARGO, Bructor, Inverurie.
566 IV.—MRS. W. G. JACKA, Ninnis, Germoe, Marazion.
562 R.N.—DR. T. W. E. ROYDEN, Fleggburgh, Norfolk.
C.—563.

Class 537.—*Indian Runner Drakes or Ducks, bred in* 1935.

574 I.—FRED ARGO, Bructor, Inverurie.
572 II.—R. ANTHONY, Euxton, Chorley, Lancs.
573 III. & 570 R.N.—THE REV. J. HEWETSON, Burbage Vicarage, Buxton.
571 IV.—REGINALD APPLEYARD, Priory Waterfowl Farm, Ixworth, Bury St. Edmunds.

Class 538.—*Drakes, any other variety.*

579 I.—REGINALD APPLEYARD, Priory Waterfowl Farm, Ixworth, Bury St. Edmunds. Muscovy.
576 II.—A. H. FOX-BROCKBANK, The Croft, Kirksanton, Millom, Cumberland. Muscovy.
577 III.—JAMES HUNTLY & SON, Hirsel P.F., Coldstream. Buff Orpington.
582 IV.—STUART T. BRIDDON, Knowts Hall, Riddings, Derbyshire. Magpie.
578 R.N.—MAJOR L. C. CHAWNER, Little Barrs, New Milton, Hants. Cayuga.
H.C.—581.

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[1] Class 531 is for birds that have secured the Copper Ring issued by the National Poultry Council, and Exhibits must wear the ring to be eligible to compete.

Class 539.—*Ducks, any other variety.*

585 I.—R. ANTHONY, Euxton, Chorley, Lancs. Khaki Campbell.
583 II.—MAJOR L. C. CHAWNER, Little Barrs, New Milton, Hants. Cayuga.
586 III.—JAMES HUNTLY & SON, Hirsel P.F., Coldstream. Buff Orpington.
584 IV.—A. H. FOX-BROCKBANK, The Croft, Kirksanton, Millom, Cumberland. Muscovy.

587 R.N.—ABBOT BROS., East of England Live Stock Farm, Thuxton, Norfolk. Muscovy.

Class 540.—*Embden Ganders or Geese.*

589 I.—CAPT. N. M. HARROP, Garthgynan, Ruthin.
590 II. & 592 R.N.—EDMUND HOLT, The Limes, Pulford, Wrexham.
591 III.—A. H. FOX-BROCKBANK, The Croft, Kirksanton, Millom, Cumberland.
594 IV.—ABBOT BROS., East of England Live Stock Farm, Thuxton, Norfolk.

H.C.—593.

Class 546.—*Spangled Old English Game Bantam Cocks or Cockerels.*

601 I.—TOM BARNES, 63, Sharp Street, Askam-in-Furness, Lancs.
598 II.—GREENHOW & HARTLEY, Galaberry P.F., Annan.
603 III.—SIDNEY NEWTON, 1, Arundel Drive, Mansfield.
597 IV.—WILLIAM TELFORD, Breconside, Brampton, Cumberland.

599 R.N.—J. F. ENTWISLE, Crigglestone Manor, Wakefield.
H.C.—596, 602.

Class 547.—*Spangled Old English Game Bantam Hens or Pullets.*

608 I.—J. F. ENTWISLE, Crigglestone Manor, Wakefield.
604 II.—H. JOHNSTON, 44, High Street, Wigton.
606 III.—GREENHOW & HARTLEY, Galaberry P.F., Annan.
610 IV.—SIDNEY NEWTON, 1, Arundel Drive, Mansfield.

607 R.N.—TOM BARNES, 63, Sharp Street, Askam-in-Furness, Lancs.
H.C.—605, 609.

Class 548.—*Old English Game Bantam Cocks or Cockerels, any other colour.*

612 I.—H. JOHNSTON, 44, High Street, Wigton.
611 II.—A. H. FOX-BROCKBANK, The Croft, Kirksanton, Millom, Cumberland.
617 III.—SIDNEY NEWTON, 1, Arundel Drive, Mansfield.
616 IV.—GREENHOW & HARTLEY, Galaberry P.F., Annan.

613 R.N.—J. F. ENTWISLE, Crigglestone Manor, Wakefield.
H.C.—615, 618.

Class 549.—*Old English Game Bantam Hens or Pullets, any other colour.*

625 I.—H. JOHNSTON, 44, High Street, Wigton.
629 II.—SIDNEY NEWTON, 1, Arundel Drive, Mansfield.
628 III.—JOS. W. ELLWOOD, Papcastle, Cockermouth.
626 IV.—GREENHOW & HARTLEY, Galaberry P.F., Annan.

621 R.N.—CAPT. E. GILES BATES, Heatheridge, Humshaugh, Northumberland.
H.C.—619, 622, 624, 627. C.—620.

Class 551.—*Wyandotte Bantam Hens or Pullets.*

632 I.—E. WHITAKER, Mayroyd House, Hebden Bridge.
631 II.—JAMES WALLBANK, Belmont, Longridge, Preston.
630 III. & 633 IV.—WILLIAM WILKINSON, Wards End, Tow Law.

Class 552.—*Sebright Bantam Cocks or Cockerels.*

636 I.—R. ANTHONY, Euxton, Chorley, Lancs.
637 II.—ROBERT BENNETT, The Butts, Frome.

Class 554.—*Rhode Island Red Bantam Cocks or Cockerels.*

644 I. & Special.—J. T. WRIGHT, Prospect House, Hemingbrough, Selby.
640 II. & R.N. for Special.—JOHN G. WILLIAMSON, Chester Road, Middlewich.
643 III.—A. G. HAYWARD, Grimshaw Lane P.F., Ormskirk.
641 IV.—ERNEST E. PICKERSGILL, Milestones, Newby, Scarborough.

639 R.N.—MRS. F. M. HEATHFIELD, The Vale P.F., Plungar, Nottingham.
H.C.—642.

Class 555.—*Rhode Island Red Bantam Hens or Pullets.*

647 I. & Special.—A. G. HAYWARD, Grimshaw Lane P.F., Ormskirk.
648 II. & R.N. for Special & 652 III.—J. T. WRIGHT, Prospect House, Hemingbrough, Selby.
650 IV.—JOHN G. WILLIAMSON, Chester Road, Middlewich.

649 R.N.—NIGEL H. HAMBRO, Coldham Hall, Bury St. Edmunds.

Class 556.—*Bantam Cocks or Cockerels, any other variety.*

659 I.—GEO. L. BOOTH, Harrop Farm, Wilsden, Bradford. Pekin.
654 II.—EDGAR P. MORTON, Salroyd House, Low Moor, Bradford. Black Rosecomb.
656 III.—R. FLETCHER HEARNSHAW, Burton Joyce, Nottingham. Barbu d'Anvers.
653 IV.—HENFIELD POULTRY FARMS, North Berwick, Polish.

657 R.N.—A. H. FOX-BROCKBANK, The Croft, Kirksanton, Millom, Cumberland. Welsummer.
H.C.—655, 658.

Class 557.—*Bantam Hens or Pullets, any other variety.*

664 I.—EDGAR P. MORTON, Salroyd House, Low Moor, Bradford. Black Rosecomb.
668 II.—GEO. L. BOOTH, Harrop Farm, Wilsden, Bradford. Pekin.
662 III.—A. H. FOX-BROCKBANK, The Croft, Kirksanton, Millom, Cumberland. Langshan.
667 IV.—R. ANTHONY, Euxton, Chorley, Lancs. Pekin.

661 R.N.—J. G. BLAIR, 71, Market Place, Wigton. Indian Game.
H.C.—663, 666. C.—660, 665.

EGGS.

The Prizes in each Class for Eggs are as follows: First Prize, 20s.; Second Prize, 15s.; Third Prize, 10s.; Fourth Prize, 5s.

Class 558.—*Six Brown Hens' Eggs.*

15 I., 17 II. & 16 III.—W. PRINGLE, East Farm, Killingworth, Newcastle-on-Tyne.
11 IV.—F. MASSEY, Lindon Common, Wilmslow, Cheshire.

5 R.N.—MISS CHARLOTTE FAWKES, Fern Bank Farm, Balsall Common, Coventry.
H.C.—7. C.—14.

Class 559.—*Six White or Cream Hens' Eggs.*

24 I.—F. W. HILL, Smallwood, Sandbach, Cheshire.
30 II.—MISS A. M. WARD, Foggathorpe Hall, Selby.
23 III.—G. GARSIDE, Oak Cottage, Mobberley, Cheshire.
28 IV.—THOMAS MUIR, Ballencrieff P.F., Bathgate.

Class 560.—*Six Tinted Hens' Eggs.*

36 I.—MRS. IONS, Lemington Lane, Felton, Morpeth.
40 II. & 39 III.—THOMAS MUIR, Ballencrieff P.F., Bathgate.
31 IV.—K. CLEMENTS, The Batch, Nailsea, Somerset.

Class 561.—*Six Ducks' Eggs.*

46 I.—J. ORANGE, Hartford Bridge P.F., Bedlington.
43 II.—MRS. IONS, Lemington Lane, Felton, Morpeth.
47 III.—W. H. STEVENS, Brooksfield, Sports Road, Glenfields, Leicester.

FARM AND DAIRY PRODUCE OF THE UNITED KINGDOM.

The Prizes in each Class for Butter are as follows: First Prize, £3; Second Prize, £2; Third Prize, £1; Fourth Prize, 10s.; Fifth Prize, 5s.

Butter.

Class 562.—*Two pounds of Fresh Butter, without any salt, made up in plain pounds, from the milk of Channel Island, Devon or South Devon Cattle and their crosses.*

58 I.—MRS. JOHN WAY, West Bridge, Bishops Nympton, South Molton, Devon.
51 II.—MRS. B. DENNIS, Pulworthy, Highampton, Beaworthy, Devon.
50 III.—MRS. E. B. BEER, Puddaven, Totnes, Devon.
54 IV.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford.

57 R.N.—MISS M. M. VARKER, Fraddam, Gwinear, Hayle, Cornwall.
H.C.—55. C.—56.

Class 563.—*Two pounds of Fresh Butter, without any salt, made up in plain pounds, from the milk of cattle of any breed or cross other than those mentioned in Class* 562.

63 I.—MISS FRANCES IRVING, Toppin Castle, Heads Nook, Carlisle.
72 II.—MISS A. M. WARD, Foggathorpe Hall, Selby.
61 III.—A. G. DENNIS, Lower Pulworthy, Highampton, Beaworthy, Devon.
71 IV.—MRS. J. G. WALTON, Bail Green, Mickleton, Yorks.

62 R.N.—MISS NANCY HUTTON, Dairy Dept., Co-operative Society, Ltd., Brunshaw, Burnley.
H.C.—68. C.—67.

Class 564.—*Two pounds of Fresh Butter, slightly salted, made up in plain pounds, from the milk of Channel Island, Devon or South Devon Cattle and their crosses.*

82 I.—MRS. JOHN WAY, West Bridge, Bishops Nympton, South Molton, Devon.
81 II.—MISS M. M. VARKER, Fraddam, Gwinear, Hayle, Cornwall.
78 III.—MRS. J. MOGFORD, Overcott, Rose Ash, South Molton, Devon.
76 IV.—MRS. B. DENNIS, Pulworthy, Highampton, Beaworthy, Devon.

79 R.N.—J. PIERPONT MORGAN, Wall Hall, Aldenham, Watford.
H.C.—80. C.—75.

Class 565.—*Two pounds of Fresh Butter, slightly salted, made up in plain pounds, from the milk of cattle of any breed or cross other than those mentioned in Class* 564.

95 I.—MRS. P. ROACH, Beersheba, Lelant, Cornwall.
97 II.—MISS A. M. WARD, Foggathorpe Hall, Selby.
86 III.—MRS. DODD, Moscow, Gilsland, Carlisle.
84 IV.—E. B. BEER, Puddaven, Totnes, Devon.
94 V.—MISS P. L. MUDD, Slade House, Darley, Harrogate.

93 R.N.—MRS. J. MILBURN, Foulbridge, Wreay, Carlisle.
H.C.—85. C.—87.

Class 566.—*Three pounds of Fresh Butter, slightly salted, made up in pounds in the most attractive marketable designs.*

105 I.—MRS. P. ROACH, Beersheba, Lelant, Cornwall.
108 II.—MISS M. M. VARKER, Fraddam, Gwinear, Hayle, Cornwall.
104 III.—MISS P. L. MUDD, Slade House, Darley, Harrogate.
99 IV.—MRS. E. B. BEER, Puddaven, Totnes, Devon.
109 V.—MISS A. M. WARD, Foggathorpe Hall, Selby.

107 R.N.—MRS. R. G. STEPHENSON, Brownbridge, Lowick, Berwick-on-Tweed.
H.C.—100. C.—103.

Cheese.

Made in 1935.

Unless otherwise stated, the Prizes in each Class for Cheese are as follows: First Prize, £5; Second Prize, £3; Third Prize, £2; Fourth Prize, 10s.; Fifth Prize, 5s.

Class 567.—*Two Cheshire Cheeses, coloured, not less than* 40 *lb. each.*

113 I.—W. E. BLAKE, Cross Lanes, Bickley, Malpas.
116 II.—J. BURSTON, Oulton Lowe, Tarporley.
123 III.—W. H. HOBSON, Woodhey Hall, Nantwich.
132 IV.—A. E. WALLEY, Lighteach, Prees, Shropshire.
121 V.—C. GRIFFITHS, Coppice Farm, Builton, Wem, Shropshire.

126 R.N.—P. KYNASTON, Blackpark, Whitchurch, Sropshire.
H.C.—110, 111, 114, 115, 129. C.—112, 117, 119, 127, 135.

Class 568.—*Two Cheshire Cheeses, uncoloured, not less than* 40 *lb. each.*

139 I.—W. H. HOBSON, Woodhey Hall, Nantwich.
136 II.—J. C. BARNETT, Hully Farm, Tybroughton, Whitchurch, Shropshire.
144 III.—THOMAS W. YOUNG, Sicilly Oak Farm, Cholmondeley, Malpas.
140 IV.—H. H. JONES, Upper Trench Farm, Wem, Shropshire.

H.C.—137, 138, 142. C.—141, 143.

Class 569.—*Two Cheshire Cheeses, coloured or uncoloured, not less than 40 lb. each, restricted to makers who have not won a 1st, 2nd or 3rd Prize at a R.A.S.E. Show for the last five years.*

154 I.—C. Griffiths, Coppice Farm, Burlton, Wem, Shropshire.
150 II.—Ernest Cooper, Darliston, Whitchurch, Shropshire.
153 III.—H. Evans, Wood Farm, Threapwood, Malpas.
168 IV.—P. H. Walley, Towns Green Farm, Wettenhall, Winsford.
167 V.—A. E. Walley, Lighteach, Prees, Shropshire.

158 R.N.—P. Kynaston, Blackpark, Whitchurch, Shropshire.
H.C.—152, 156, 162, 165, 169. C.—147, 148.

Class 570.—*Two Cheddar Cheeses, not less than 50 lb. each.*

170 I.—Samuel McMinn, Torrs Dairy, Kirkcudbright.
172 II.—Frank Portch, Leigh Farm, Wincanton, Somerset.
171 III.—Monmouthshire Agricultural Institute, Usk.

Class 571.—*Two Cheddar Truckles.*

174 I.—Cheddar Valley Dairy Co., Ltd., Rooksbridge, Axbridge.
175 II.—Mrs. S. A. Harris, Nantyderry, Abergavenny.
178 III.—Frank Portch, Leigh Farm, Wincanton, Somerset.

176 R.N.—Samuel McMinn, Torrs Dairy, Kirkcudbright.

Class 572.—*Two Stilton Cheeses.*

181 I.—Emberlin & Co., Ltd., Wymeswold, Loughborough.
189 II.—Wilts. United Dairies, Ltd., Swepstone, Leicester.
180 III.—Emberlin & Co., Ltd., Old Dalby, Melton Mowbray.

185 R.N.—Scalford Dairy, Ltd., Scalford, Melton Mowbray.
H.C.—182. C.—183, 184.

Class 573.—*Two Wensleydale Cheeses, Stilton shape.*

191 I.—Miss Rachel James, Llancayo, Usk.
193 II.—Alfred Rowntree & Sons, Coverham, Middleham, Yorks.
192 III.—Miss B. J. Mudd, Aldborough Dairy, Boroughbridge.

Class 574.—*Two Cotherstone Cheeses.*

194 II.—Alfred Rowntree & Sons, Coverham, Middleham, Yorks.

Class 576.—*Two Caerphilly Cheeses.*

195 I.—Cheddar Valley Dairy Co., Ltd., Rooksbridge, Axbridge.
198 II.—Mrs. John, Ruthin Farm, St. Mary Hill, Bridgend.
196 III.—Mrs. S. A. Harris, Nantyderry, Abergavenny.

199 R.N.—Miss Mary Lee, Ruthin Farm, St. Mary Hill, Bridgend.
H.C.—200.

Class 577.—*Two Small Cheeses, not exceeding 6 lb. each, of Cheddar or Cheshire character.*

208 I. £4.—Ruyton Co-operative Dairies, Ltd., Ruyton-Eleven-Towns, Shropshire.
207 II. £2.—Frank Portch, Leigh Farm, Wincanton, Somerset.
205 III. £1.—Merrefield Model Dairy, Haslington, Crewe.
210 IV. 10s.—P. H. Walley, Towns Green Farm, Wettenhall, Winsford.
206 V. 5s.—Monmouthshire Agricultural Institute, Usk.

202 R.N.—Thomas E. Beckett, Hall o' Coole, Nantwich.

Class 578.—*Two Small Cheeses, not exceeding 6 lb. each, of Stilton or Wensleydale character.*

216 I., £4.—J. M. Nuttall & Co., Ltd., Dove Dairy, Hartington, Buxton.
217 II., £2.—Alfred Rowntree & Sons, Coverham, Middleham, Yorks.
220 III., £1.—Webster & Richardson, Hickling Lodge, Kinoulton, Notts.
213 IV., 10s.—Long Clawson Dairy, Ltd., Hose, Melton Mowbray.

215 R.N.—Miss B. J. Mudd, Aldborough Dairy, Boroughbridge.
H.C.—214.

Class 579.—*Two Soft Cheeses, made from whole milk.*

224 I. £4.—Monmouthshire Agricultural Institute, Usk.
221 II. £2.—Miss E. Allday, Fotheringay Manor, Peterborough.
225 III. £1.—Miss B. J. Mudd, Aldborough Dairy, Boroughbridge.

Class 580.—*Two Cheeses, made from cream without the addition of rennet.*

233 I. £4.—MRS. HERBERT OKEDEN, Stutton House, Stutton, Ipswich.
238 II. £2.—W. B. C. TREGARTHEN, Colburian Farm, Ludgvan, Long Rock, Cornwall.
227 III. £1.—MRS. H. CROSBY, Auburn House, West Rounton, Northallerton.
232 IV. 10s.—CAPT. & MRS. V. MORSE, Upper Cowden, Five Ashes, Sussex.
231 V. 5s.—MONMOUTHSHIRE AGRICULTURAL INSTITUTE, Usk.

226 R.N.—MRS. G. J. CADDEY, Manor House, Egham, Surrey.
H.C.—235. C.—228.

Cider.

The Prizes in each Class for Cider are as follows: First Prize, £3; Second Prize, £2; Third Prize, £1; Fourth Prize, 10s.

Class 581.—*Casks of Cider, not less than 6 gallons, made in* 1934 *by a bona-fide Farmer.*

242 I.—S. J. SHEPPY & SON, Three Bridges, Taunton.
239 II. & 240 III.—HERBERT W. DAVIS, Sutton Montis, Yeovil.

C.—241.

Class 582.—*Six bottles of Dry Cider, made in* 1934.

251 I.—S. J. SHEPPY & SON, Three Bridges, Taunton.
243 II.—HERBERT W. DAVIS, Sutton Montis, Yeovil.
247 III.—QUANTOCK VALE CIDER CO., LTD., North Petherton, Bridgwater.
248 IV.—H. H. SEALY & SON, Honeyhurst, Rodney Stone, Cheddar.

C.—244.

Class 583.—*Six bottles of Sweet Cider, made in* 1934.

255 I.—H. H. SEALY & SON, Honeyhurst, Rodney Stone, Cheddar.
252 II.—HERBERT W. DAVIS, Sutton Montis, Yeovil.
254 III.—PULLIN BROS., Compton Greenfield, Bristol.
258 IV.—SEVERN VALE CIDER CO., LTD., Bushley, Gloucester.

253 R.N.—GLOUCESTERSHIRE CIDER CO., LTD., Wickwar, Glos.

Class 584.—*Six bottles of Cider, made previous to* 1934.

262 I. & 263 III.—SEVERN VALE CIDER CO., LTD., Bushley, Gloucester.
261 II.—GLOUCESTERSHIRE CIDER CO., LTD., Wickwar, Glos.

265 R.N.—S. J. SHEPPY & SON, Three Bridges, Taunton.
C.—264.

Wool.[1]

Of 1935 clip.

First Prize, £3; Second Prize, £2; Third Prize, £1, in each Class.

Class 585.—*Three Fleeces of Oxford Down Wool.*

268 I.—F. W. DENNIS, Crossgates Farm, Seamer, Scarborough.
266 II. & 267 III.—LAWRENCE B. AKERS, Litchfield Farm, Enstone, Oxford.

Class 586.—*Three Fleeces of Shropshire Wool.*

274 I. & 275 II.—E. CRAIG TANNER, Eyton-on-Severn, Wroxeter, Shropshire.
273 III.—JOHN MINTON, Condover Grange, Shrewsbury.

272 R.N.—A. E. & W. EVERALL, Sherlowe, Wellington, Shropshire.

Class 587.—*Three Fleeces of Southdown Wool.*

276 I. & R.N. for Special,[2] & 277 II.—HIS MAJESTY THE KING, Sandringham.
278 III. & 279 R.N.—LADY LUDLOW, Luton Hoo, Luton.

H.C.—283.

Class 588.—*Three Fleeces of Hampshire Down Wool.*

288 I. & 289 II.—WILLIAM TODD, Little Ponton Grange, Grantham.
287 III.—E. CLIFTON-BROWN, Burnham Grove, Burnham, Bucks.

285 R.N.—MAJOR V. S. BLAND, The Warren, Aldbourne, Marlborough.

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[1] The Second and Third Prizes in these Classes were given by the respective Flock Book Societies.

[2] Special Cash Prize, known as the "Merchants of the Staple of England" Prize, given for the best fleece taken from any short-woolled breed of sheep.

Class 590.—*Three Fleeces of Dorset Down Wool.*

293 I. & 294 II.—LEONARD TORY, Turnworth, Blandford.
291 III. & 292 R.N.—THE EARL OF ELGIN, K.T., C.M.G., Broomhall, Dunfermline.

Class 591.—*Three Fleeces of Dorset Horn Wool.*

297 I. & 298 II.—ALFRED READ, Lower Farm, Hilton, Blandford.
296 III. & 295 R.N.—THE EARL OF ELGIN, K.T., C.M.G., Broomhall, Dunfermline.

Class 592.—*Three Fleeces of Ryeland Wool.*

302 I. & Special.[1]—DAVID J. THOMAS, Monachty, Abergavenny.
299 II., 301 III. & 300 R.N.—T. W. MONTAGUE PERKINS, Ufton Court, Holme Lacy, Hereford.

H.C.—303.

Class 593.—*Three Fleeces of Kerry Hill (Wales) Wool.*

304 I.—JOHN T. BEAVAN, Winsbury, Chirbury, Montgomery.

Class 594.—*Three Fleeces of Lincoln Wool.*

305 II. & Special.[2]—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.

Class 596.—*Three Fleeces of Wensleydale Wool.*

308 I. & R.N. for Special.[2]—JOHN A. WILLIS, Manor House, Carperby, Yorks.
306 II.—JOHN W. GREENSIT, Holme-on-Swale, Thirsk.
307 III.—JOHN PERCIVAL, Easthouse, Carperby, Yorks.

Class 597.—*Three Fleeces of Kent or Romney Marsh Wool, from Rams of any age.*

312 I.—ASHLEY STEVENS, Davington Hall, Faversham.
309 II.—E. W. BAKER, Bekesbourne, Canterbury.
310 III.—L. H. FINN, The Mall, Faversham.

311 R.N.—J. EGERTON QUESTED, The Firs, Cheriton, Kent.

Class 598.—*Three Fleeces of Kent or Romney Marsh Wool, from Ewe Tegs.*

314 I.—L. H. FINN, The Mall, Faversham.
315 II.—CLIFFORD NICHOLSON, Willoughton Manor, Lincoln.
316 III.—J. EGERTON QUESTED, The Firs, Cheriton, Kent.

313 R.N.—E. W. BAKER, Bekesbourne, Canterbury.
H.C.—317.

Class 599.—*Three Fleeces of Kent or Romney Marsh Wool, excluding Rams or Ewe Tegs.*

323 I.—ASHLEY STEVENS, Davington Hall, Faversham.
320 II.—L. H. FINN, The Mall, Faversham.
318 III.—E. W. BAKER, Bekesbourne, Canterbury.

322 R.N.—J. EGERTON QUESTED, The Firs, Cheriton, Kent.
H.C.—319.

Class 600.—*Three Fleeces of Welsh Mountain Wool.*

327 I. & 326 II.—UNIVERSITY COLLEGE OF NORTH WALES, Bangor.
328 III.—J. K. WILLIAMSON, Derwen Hall, Ruthin.

Class 601.—*Three Fleeces of Black Welsh Mountain Wool.*

332 I.—MRS. JERVOISE, Herriard Park, Basingstoke.
330 II. & 329 III.—MISS J. V. HORN, Woodcote Park, Blackshiels, Midlothian.
331 R.N.—MAJOR F. H. T. JERVOISE, Herriard Park, Basingstoke.

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[1] Special Cash Prize, known as the "Merchants of the Staple of England" Prize, given for the best fleece taken from any short-woolled breed of sheep.
[2] Special Cash Prize, known as the "Merchants of the Staple of England" Prize, given for the best fleece taken from any long-woolled breed of sheep.

BUTTER-MAKING COMPETITIONS.

Class 1.—*Open to Students who have attended a course at the Durham County Dairy School, Houghall, or the Cumberland and Westmorland Farm Schools, Newton Rigg, and who have not won a First Prize at any Show.*

15 I. (£4).—Miss Kathleen Ward, County Dairy, Houghall, Durham.
2 II. (£3).—Miss Peggie Armorey, Primroseside Farm, New Brancepeth.
19 III. (£2).—Miss Mabel Wilson, County Dairy, Houghall, Durham.
9 IV. (£1).—Miss Annie Johnson, County Dairy, Houghall, Durham.

7 R.N.—Miss Olga Humble, County Dairy, Houghall, Durham.
H.C.—1, 3. C.—14.

Class 2.—*Open to Students who have received not less than one month's instruction at any Dairy School and who have not won a First or Second Prize at the R.A.S.E., London Dairy, Bath and West, Royal Counties, Royal Lancashire or Yorkshire Shows.*

Section A.

23 I. (£4).—Miss Mona Almond, Lancs. C.C. Dairy School, Hutton, Preston.
35 II. (£3).—Miss Nesta M. Lewis, Monmouthshire Agricultural Institute, Usk.
37 III. (£2).—Miss Marjorie Massey, Lancs. C.C. Dairy School, Hutton, Preston.
33 IV. (£1).—Miss Olga Humble, County Dairy, Houghall, Durham.

30 R.N.—Miss Mabel Edwards, Walsgrove Farm, Great Witley, Worcester.
H.C.—25. C.—28.

Section B.

51 I. (£4).—Miss Mabel Wilson, County Dairy, Houghall, Durham.
39 II. £3).—Miss Maria Ann Murray, Faugh Beeches, Heads Nook, Carlisle.
49 III. (£2).—Miss E. Mary Williams, Monmouthshire Agricultural Institute, Usk.
41 IV. (£1).—Miss Inez G. Roach, Beersheba, Lelant, Cornwall.

46 R.N.—Miss Kathleen Ward, County Dairy, Houghall, Durham.
H.C.—42, 43.

Class 3.—*Open to those who have not won a First or Second Prize at any Show.*

59 I. (£4).—Miss Phyllis Crump, Lodge Farm, Raglan, Mon.
68 II. (£3).—Miss Inez G. Roach, Beersheba, Lelant, Cornwall.
65 III. (£2).—Miss Marjorie Massey, Lancs. C.C. Dairy School, Hutton, Preston.
74 IV. (£1).—Miss Mabel Wilson, County Dairy, Houghall, Durham.

70 R.N.—Miss Bessie Thornborrow, Crackenthorpe, Appleby.
H.C.—60, 61. C.—73.

Class 4.—*Open, except to Champions at the R.A.S.E., London Dairy, Bath and West, Royal Counties, Royal Lancashire or Yorkshire Shows.*

Section A.

85 I. (£5).—Miss Margaret A. Edwards, Humber Court, Leominster.
87 II. (£4).—Miss Olga Eustice, Bezurrel, Gwinear, Hayle, Cornwall.
80 III. (£3).—Miss Dora Browning, The Storks, Ombersley, Worcester.
79 IV. (£2).—Miss Lily Bromley, Trethewey, Germoe, Marazion.
84 V. (£1).—Miss Phyllis Crump, Lodge Farm, Raglan, Mon.

90 R.N.—Miss J. K. Hoy, Glencoe, 34, College Road South, Great Crosby, Liverpool.
H.C.—81, 83. C.—88.

Section B.

104 I. (£5).—Miss Winifred H. Reynolds, Wern-y-cwm, Abergavenny.
101 II. (£4).—Miss Monica M. Olde, Clifton House, Boscastle, Cornwall.
102 III. (£3).—Miss P. Peer, Rectory Farm, Tibberton, Droitwich.
105 IV. (£2).—Miss Inez G. Roach, Beersheba, Lelant, Cornwall.
96 V. (£1).—Miss G. D. Matthews, Bowers Farm, Bridstow, Ross-on-Wye.

109 R.N.—Miss Marion M. Walmsley, 17, Grange Road West, Vicar's Cross, Chester.
H.C.—98, 106. C.—93.

Class 5.—*Inter-County Championship for teams of three, one of whom must be a Novice never having won a First or Second Prize up to the time of entry, the second member must not have won more than three First Prizes and must never have won any Championship, the third member may be a Champion at this or any Show.*

119 I. (£3 & Silver Medal each).—Miss Mabel Edwards, Walsgrove Farm, Great Witley, Worcester. Miss Dora Browning, The Storks, Ombersley, Worcs. Miss P. Peer, Rectory Farm, Tibberton, Droitwich.
117 II. (£2 each).—Miss Nesta M. Lewis, Monmouthshire Agricultural Institute, Usk. Miss Winifred H. Reynolds, Wern-y-cwm, Abergavenny. Miss Flossie Lewis, Court Farm, Llanmartin, Newport, Mon.
116 III. (£1 each)—Miss Mona Almond, Lancs. C.C. Dairy School, Hutton, Preston. Miss J. K. Hoy, 34, College Road South, Great Crosby. Miss M. M. Holey, Lancs. C.C. Dairy School, Hutton, Preston.
112 R.N.—Miss Inez G. Roach, Beersheba, Lelant, Cornwall. Miss Monica M. Olde, Clifton House, Boscastle, Cornwall. Miss Olga Eustice, Bezurrel, Gwinear, Hayle, Cornwall.
H.C.—114, 115. C.—111.

Class 6.—*Championship open to the First Prize Winners in the preceding Classes or at any previous R.A.S.E. Show, and to Champions of the London Dairy, Bath and West, Royal Counties, or any County Show.*

126 I. (£5 & Gold Medal).—Miss Jane M. Olde, Clifton House, Boscastle, Cornwall.
128 II. (£4).—Miss Winifred H. Reynolds, Wern-y-cwm, Abergavenny.
101 III. (£3).—Miss Monica M. Olde, Clifton House, Boscastle, Cornwall.
129 IV. (£2).—Miss M. E. Sandercock, Venterdon, Stoke Climsland, Callington, Cornwall.
131 V. (£1).—Miss G. D. Matthews, Bowers Farm, Bridstow, Ross-on-Wye.

120 R.N.—Miss Lily Bromley, Trethewey, Germoe, Marazion, Cornwall.
H.C.—93, 127. C.—86.

FLOWER SHOW.

Class 1.—*Groups of Miscellaneous Plants.*

1 I. (£40).—James Cypher & Sons, Ltd., Queen's Road Nurseries, Cheltenham.
2 II. (£30).—T. M. Petch, Highfield Nursery, Poplar Grove, Great Norton, Bradford.

Class 2.—*Collections of Delphiniums.*

3 I. (£6).—Blackmore & Langdon, Bath.
5 II. (£4).—Hewitt & Co., Ltd., Solihull, Warwickshire.

Class 3.—*Groups of Tuberous Begonias in pots.*

7 I. (£20).—Blackmore & Langdon, Bath.

Class 4.—*Groups of Aquatic and Semi-Aquatic Plants.*

8 I. (£20).—M. Prichard & Sons, Ltd., Riverslea Nurseries, Christchurch, Hants.
9 II. (£15).—Stephen Sims, Draycott, Derbyshire.

Class 5.—*Collections of Hardy Perennial Plants and Cut Blooms.*

11 I. (£30).—Bees, Ltd., Sealand Nurseries, Chester.
10 II. (£25).—William Artindale & Son, Nether Green, Sheffield.
14 III. (£20).—Hewitt & Co., Ltd., Solihull, Warwickshire.

16 Special Prize of £15.—T. A. Lawrenson, 9, Gallowgate, Newcastle-on-Tyne, for best arranged Herbaceous Border.

Class 6.—*Collection of Tree Carnations.*

18 I. (£15 & Cup).[1]—C. Engelmann, Ltd., Saffron Walden, Essex.
19 II. (£10 & R.N. for Cup).[1]—Stuart Low & Co., Bush Hill Park, Enfield.

Class 7.—*Collections of Cut Sprays of Border Carnations.*

20 I. (£15).—Horace Lakeman, Queensberry Nursery, Thornton Heath, Surrey.

Class 8.—*Collections of Sweet Peas.*

21 I. (£15).—G. H. Brookshaw, Stock Lane, Hough, Crewe.
22 II. (£10).—Ralph Challinor, The Gardens, Lilleshall, Wellington, Shropshire.

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[1] Perpetual Challenge Cup awarded to Winner of First Prize in Class 6.

Class 9.—*Collections of Cut Roses.*

27 I. (£15).—THOMAS ROBINSON, Porchester Nurseries, Nottingham.
26 II. (£10).—WILLIAM LOWE & SON, The Nurseries, Beeston, Notts.
25 III. (£7).—C. GREGORY, Old Close Nurseries, Chilwell, Nottingham.

Exhibits not for Competition.

Large Gold Medals to :—

28 ALLWOOD BROS., Wivelsfield Nurseries, Haywards Heath. Carnations.
35 CONWAYS, LTD., Halifax. Rock and Water Garden.
39 DOBBIE & CO., LTD., Edinburgh. Roses, Dahlias and Sweet Peas.
48 T. A. LAWRENSON, 9, Gallowgate, Newcastle-on-Tyne. Rock and Water Garden.
56 JOHN PEED & SON, West Norwood, London, S.E.27. Greenhouse Plants.
63 STUDLEY COLLEGE, Studley, Warwickshire. Fruits and Vegetables.
64 SUTTON & SONS, LTD., Reading. Border Plants and Annuals.

Gold Medals to :—

29 BACKHOUSE NURSERIES (YORK), LTD., The Nurseries, York. Miniature Rock Garden.
30 BAKERS, Codsall, Wolverhampton. Delphiniums.
38 ALEX. DICKSON & SONS, LTD., Hawlmark, Marks Tey, Essex. Cut Roses.
46 HORACE LAKEMAN, Queensberry Nursery, Thornton Heath, Surrey. Cut Border Carnations.
51 STUART LOW & CO., Bush Hill Park, Enfield. Orchids and Carnations.
61 L. R. RUSSELL, LTD., Richmond Nurseries, Richmond, Surrey. Water Lilies and other Aquatics and Waterside Plants.

Silver Gilt Medals to :—

31 BEES, LTD., Sealand Nurseries, Chester. Delphiniums.
45 LAIRD & DICKSON, Pinkhill Nurseries, Edinburgh. Rock Plants.
52 S. MCGREDY & SON, Royal Nurseries, Portadown, Northern Ireland. Roses.
53 MAXWELL & BEALE, LTD., Broadstone, Dorset. Miniature Rock Garden, planted with Heathers, Alpines and Primulas.
62 J. F. SPENCER & SON, Hockley, Essex. Dahlias.
66 TOOGOOD & SONS, LTD., Southampton. Floral Display.

FLORAL DISPLAY.

Silver Medals to :—

32 FRED J. BELL, Crescent Nurseries, Whitley Bay. Pansies and Violas.
68 BENJAMIN R. CANT & SONS, LTD., The Old Rose Gardens, Colchester. Roses.
34 E. CLEGG, The Nurseries, Dewsbury. Violas, Pansies and Dahlias.
37 DANIELS BROS., LTD., Norwich. Lilies, Gladioli, Perennials, etc.
40 JOHN FORBES (HAWICK), LTD., Buccleuch Nurseries, Hawick. Phloxes, Pentstemons and Cut Herbaceous Flowers.
44 KELWAY & SON (1933), LTD., Langport, Somerset. Pæonies, Hardy Plants, etc.
47 W. H. LAMBERT, Madresfield Gardens, Malvern. Roses.
57 R. W. PROCTOR & SONS, The Hardy Derbyshire Rose Nurseries, Chesterfield. Cut Roses.
67 WHEATCROFT BROS., LTD., Ruddington, Nottingham. Rose Garden.

IMPLEMENTS.

Silver Medals for articles entered as "New Implements for Agricultural or Estate Purposes."

560 BLACKSTONE & CO., LTD., Stamford. Tractor Transportable Rake.

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AGRICULTURAL COUNCIL OF DENMARK. Denmark Agriculture. Copenhagen, 1935 . . . . *Mr. S. Sörensen*

AGRICULTURAL DILEMMA, THE. Report of an enquiry organized by Viscount Astor and Mr. B. Seebohm Rowntree. London, 1935 . . . . *Purchased*

AGRICULTURAL ECONOMICS RESEARCH INSTITUTE. The Agricultural Register, 1934–1935. Oxford, 1935 . . . *Director*

——— Miscellaneous Papers, Vol. VII, 1931–34. Oxford, 1935. *Director*

AGRICULTURAL ECONOMISTS, PROCEEDINGS OF THIRD INTERNATIONAL CONFERENCE OF, at Bad Eilsen, Germany, 26th August to 2nd September, 1934. London, 1935 . *Purchased*

AGRICULTURAL RESEARCH COUNCIL. Report by a Committee on the Preservation of Grass and other Fodder Crops. (A.R.C. Report Series No. 1.) 1935. *Council*

——— Observations by the Tuberculosis Committee on the Experiment with Spahlinger Vaccine in Northern Ireland. London, 1935 . . . . *Council*

BARKER, A. S. The Use of Fertilizers. A Guide to the Manuring of Crops in Great Britain. London, 1935 . . . *Purchased*

BEZEMER, T. J. Dictionary of Terms relating to Agriculture, Horticulture, Forestry, Cattle Breeding, Dairy Industry and Apiculture, in English, French, German and Dutch. London, 1934 . . . . *Publishers*

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CANADA YEAR BOOK, 1934–35. Ottawa, 1935 . *High Commissioner*

CARNEGIE UNITED KINGDOM TRUST. Land Settlement. A Report prepared for the Trustees. By A. W. Menzies-Kitchin, M.A. Edinburgh, 1935 . . . . . *Trust*

CONACHER, H. M. The Agricultural Marketing Acts, 1931 and 1933. Edinburgh, 1935 . . . . *Purchased*

CUTLER, D. W., and L. M. CRUMP. Problems in Soil Microbiology. (Rothamsted Monograph on Agricultural Science.) London, 1935 . . . . *Purchased*

DAVIES, CLEMENT E. Agricultural Holdings and Tenant Right. 3rd ed. With chapters on the Practice of Tenant Right Valuation by N. E. Mustoe; and Customs of the Country by J. E. Tory. London, 1935 . . . . . *Purchased*

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EMPIRE JOURNAL OF EXPERIMENTAL AGRICULTURE, Vol. III, 1935 . . . . *Purchased*

ENCYCLOPAEDIA OF VETERINARY MEDICINE, SURGERY AND OBSTETRICS. 2nd ed., 2 vols., edited by G. H. Wooldridge. London, 1934 . . . . *Purchased*

GUNN, EDWIN. Farm Buildings, new and adapted. A Guide for Farmers, Land Agents and Architects. Edited and published by H. C. Long, 1935 . . . . *Publisher*

Hannah Dairy Research Institute. An Enquiry into the Design, Operation and Efficiency of Pasteurizing Plants. By A. W. Scott and Norman C. Wright. Bulletin No. 6, 1935 . . . . *Institute*

Horace Plunkett Foundation. Co-operation and the New Agricultural Policy. London, 1935 . . . . . *Purchased*

Howard, Louise E. Labour in Agriculture. An International Survey. London, 1935 . . . . *Publishers*

Imperial Economic Committee. Meat. A Summary of Figures of Production and Trade relating to Beef, Mutton and Lamb, Bacon and Hams, Pork, Cattle, Sheep, Pigs, Canned Meat. I.E.C./C/1. May, 1935 . . . . *Purchased*

——— Mutton and Lamb Survey. A Summary of Production and Trade in the Empire and Foreign Countries. I.E.C./S/3. September, 1935 . . . . *Purchased*

——— Canned and Dried Fruit Supplies in 1934. July, 1935.

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——— Wool Production and Trade, 1928–34. 1935.

Institute for Research in Agricultural Engineering. Farm and Machine, Vol. II, comprising the Report of the Institute for the year ended September, 1934, and Miscellaneous Papers on Agricultural Engineering. Oxford, 1935 . . . . *Institute*

——— Notes on the Technique of Mechanised Farming. By J. E. Newman. Oxford, 1934 . . . . . . *Institute*

——— Electricity in Poultry Farming. By C. A. Cameron Brown. Oxford, 1935 . . . . *Institute*

International Institute of Agriculture. The World Agricultural Situation in 1933–34. Rome, 1935 . . *Institute*

Journal of Agricultural Science, Vol. XXIII, 1933, Vol. XXIV, 1934, and Vol. XXV, 1935 . . . . . *Purchased*

Knott, J. E. Vegetable Growing. 2nd ed., thoroughly revised. Illustrated with 70 engravings. (Printed in America.) London, 1935 . . . . *Publisher*

Ministry of Agriculture and Fisheries. Bulletins: No. 16, Variations in the Composition of Milk (2nd ed.); No. 23, Edible and Poisonous Fungi; No. 34, Mushroom Growing; No. 83, Experiments on In-breeding Poultry; No. 89, Osiers and Willows (3rd ed.); No. 91, Experiments in Table Poultry Production . . . . *Ministry*

——— Collected Leaflets—No. 3, Diseases of Potatoes . *Ministry*

——— Economic Series Reports—No. 25, Vegetable Marketing in England and Wales; No. 42, Eggs and Poultry. Report of Reorganization Commission (England and Wales); No. 43, Eggs and Poultry. Report of Reorganization Commission (Great Britain) . . . . *Purchased*

National Pig Breeders' Association. Pig Breeders' Annual. Vol. 15, 1935–36 . . . . *Association*

Northern Ireland Ministry of Agriculture. Report on the Spahlinger Experiments in Northern Ireland, 1931–34. Belfast, 1935 . . . . *Purchased*

Orwin, C. S., and W. F. Darke. Back to the Land. London, 1935 . . . . *Purchased*

Oxford Forestry Memoir. No. 19, The Use and Misuse of Land. By R. Maclagan Gorrie. 1935 . . . . *Publishers*

PRENTICE, E. PARMALEE. Breeding Profitable Dairy Cattle. Boston, U.S.A. and London, 1935 . . . . *Purchased*

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ROTHAMSTED EXPERIMENTAL STATION. Rothamsted Memoirs of Agricultural Science, Vols. XVII, 1931–33, XVIII, 1923–34 *Director*

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SOUTH EASTERN AGRICULTURAL COLLEGE, Department of Economics. Report No. XXI: Financial Results on the College Farms; V: Sheep Breeding and Feeding over Four Years, 1930–31 to 1933–34. By J. Wyllie and N. V. Hewison *College*

——— Report No. XXII: Investigation into Farming Costs of Production and Financial Results; XVI: Financial Problems in Poultry Keeping. By J. Wyllie . . *College*

STAPLEDON, Prof. R. G. The Land Now and To-morrow. London, 1935 . . . . *Purchased*

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——— Accounts, 1933.

MINISTRY OF AGRICULTURE AND FISHERIES. Agricultural Statistics, 1934, Part I.

——— Report of Proceedings under the Agricultural Wages (Regulation) Act, 1924, for the year ended 30th September, 1934.

——— Report of the Land Division of the Ministry for 1934.

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Forestry.

FORESTRY COMMISSION. 15th Annual Report, for year ended 30th September, 1934.

Meat.

IMPORTS OF MEAT INTO THE UNITED KINGDOM. Statement of the Views of His Majesty's Government in the United Kingdom. Cmd. 4828, 1935.

Oversea Settlement.

OVERSEA SETTLEMENT COMMITTEE. Report for period 1st April, 1934, to 31st March, 1935. Cmd. 4993, 1935.

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MINISTRY OF AGRICULTURE AND FISHERIES. British Sugar Beet (Subsidy) Acts, 1925 and 1934. Statements in the form of balance-sheets transmitted to the Minister by companies which manufactured in Great Britain, in 1934–35, sugar and/or molasses from home-grown beet. Section I: Factories.

UNITED KINGDOM SUGAR INDUSTRY ENQUIRY COMMITTEE Report. Cmd. 4871, 1935.

SUGAR POLICY. Proposals of His Majesty's Government. Cmd. 4964, 1935.

Wheat.

WHEAT ACT, 1932. Report of Standard Price Committee. Cmd. 4932, 1935.

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